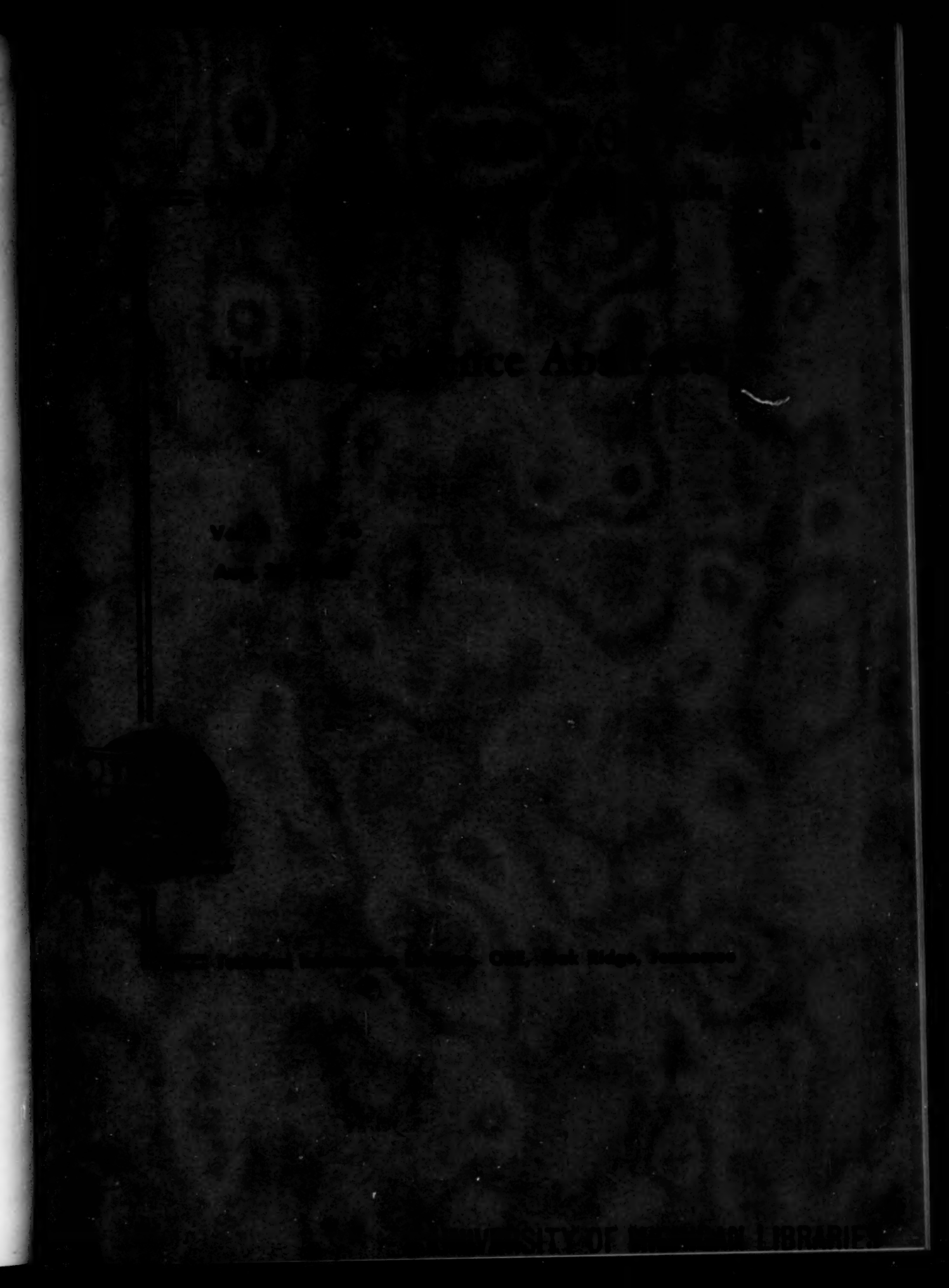

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ERRATA

The correct title of the paper abstracted in NSA 4-4104 is "Measurement of a 1.6×10^{-9} Second Half-Life in Yb^{170}."

The correct journal reference for NSA 4-3291 is Fort Dodge Biochemic Review.

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BIOLOGY AND MEDICINE

4727 Activity in Tissues Induced by Slow Neutron Bombardment. H. J. Curtis and J. D. Teresi. AECD-2872, Feb. 25, 1946, Decl. June 27, 1950. 21p.

When tissue is exposed to slow neutrons, a nuclear reaction takes place between the neutrons and the various atoms of the tissue which will produce radioactive isotopes. It can be shown theoretically that phosphorus and sodium are the most dangerous elements in this regard, and this prediction has been borne out in experiments on mice. However, it is shown that this radiation produced only about 1% of the biological effect produced by a slow neutron exposure; the rest being due to radiations emitted at the time of the exposure. From an analysis of the urine for radioactive elements it is possible to estimate the magnitude of a slow neutron exposure. Either phosphorus or sodium analysis should be used depending upon the circumstances of the exposure and the analysis; but in general it may be said that sodium analysis should be used for short exposures and phosphorus for chronic exposures. A tolerance dose of slow neutrons has been computed as an 8-hr exposure in a flux of 9×10^3 n/cm²/sec. Using this value it can be shown that under most circumstances it would be possible to detect an over-exposure by a urine analysis, but this is not recommended as a routine procedure. (auth)

4728 A Semi-quantitative Study of Bone Marrow in Rats Following Total Body X-irradiation. Robert L. Rosenthal, Bryant I. Pickering, and Leontine Goldschmidt. Naval Radiological Defense Laboratory Final Report No. AD-217(B), May 8, 1950. 19p.

A method is presented for the quantitative enumeration of the bone marrow cells by adjusting the differential count for the degree of cellularity, which is derived from imprint preparations of femoral marrow. This method has been employed in a study of bone marrow changes at various intervals following 700 r of total body x-irradiation in the rat. The findings have been correlated with the peripheral blood counts. The erythroid cells of the bone marrow show rapid decreases in number because of their marked destruction. The myeloid cells chiefly undergo accelerated maturation. The decreases in megakaryocytes, mast cells and lymphocytes appear to be related to their life spans and the absence of further production. The reticulum cells and plasma cells show neither an absolute increase nor decrease. Formation of new cells, except possibly for plasma cells, from the reticulum cells is completely inhibited for the first nine days following total body irradiation of rats with 700 r. Regeneration is first apparent at 12 days after x-ray as evidenced by areas of erythropoiesis, and, to a lesser extent, Myelopoiesis. Megakaryocytes reappear in small numbers at 15 days. Although this regeneration is apparent in only 50% of the animals studied at 12 and 15 days following irradiation, all these animals showed evidence of transition of reticulum cells to mast cells. 29 references. (auth)

4729 Action of Ionizing Radiations on Aqueous Solutions. Joseph Weiss. J. chim. phys. 46, 593-6(1949)(in French).

In a lecture delivered in Paris, the author outlined his views on the action of ionizing radiations on aqueous solutions. Unlike photochemical agents, for which water is transparent and the primary action is localized in the dissolved substance, the ionizing agents act primarily upon water molecules. Electron transfers lead to the formation of ions H_2O^+ and H_2O^- which decompose into $(H^+ + OH)$ and $(OH^- + H)$ respectively, thus producing neutral fragments OH and H, capable of various interactions with a number of dissolved substances. Several examples of such reactions and their physico-chemical characteristics are given. The importance of these studies in the field of radiobiology is shown by certain transformations of organic compounds obtained by the author and explained according to his views, (irradiation of phenols, amino acids, etc.)

4730 Augmentation of the Cutaneous Radiosensitivity of the Rabbit Resulting from the Action of Insulin. Georges Velley and Jean Loiseleur. Compt. rend. 230, 2132-3(1950) June 12 (in French).

Rabbits were irradiated with various doses of x-radiation (2250 to 3000 r) after receiving an injection of insulin (0.5 clinical units per kilogram). The onset of epilation at the exposed area was greatly accelerated by the insulin injection. The explanation the authors offer for this is as follows: When cellular oxygen becomes activated by x-rays, its activity is shared by the metabolic molecules, principally glucose, and the cellular components (the case of the appearance of radiolesions). The insulin hypoglycemia, causing the oxidation of the cellular constituents to be preponderant, results in an increase in the cutaneous radiosensitivity. (auth)

4731 Effect of Adrenalectomy on Radiation Induced Mortality of the Mouse. E. P. Cronkite and W. H. Chapman. Proc. Soc. Exptl. Biol. Med. 74, 337-40 (1950) June.

Adrenalectomized and control mice were exposed at the rate of 15 r/min to the beam of a 2-Mv x-ray tube. The results were: (1) The adrenalectomized or "adrenal insufficient" mouse is more sensitive to irradiation than the normal mouse. (2) The survival time of adrenalectomized mice is shortened. (3) Mice adrenalectomized 48 hr before irradiation were more sensitive than those adrenalectomized 15 days before irradiation. (4) The cause of death in the adrenalectomized irradiated mouse is apparently due to mechanisms other than infection and hemorrhage.

4732 Killing of Bacterium Coli with Fast Electrons of a 6-Mev Betatron. C. Dieckmann and W. Dittrich. Strahlentherapie 81, 215-22(1950) (in German).

An agar-plate technique was devised for the investigation of the rate of deterioration of Bacterium coli commune by fast electrons and x-rays. In agreement with the "event" or "hit" theory of radiobiological processes, 3-Mev electrons were found to be more effective for the above reaction than equal doses of x-rays of 180 kv, 6 ma, 0.27 mm half-value layer and 500 r/min dose rate; the dose range was 500 to 4000 r. The radiobiological effect produced by the electrons is interpreted as a saturation process, in the sense of the above theory; the radio-sensitive volume is composed of about 60 elementary fields of 21 mμ average width. (auth)

4733 Medical Aspects of Atomic Energy. G. H. Henry. Proc. Staff Meeting Hillcrest Memorial Hosp. 6, 172-7(1950) Mar.

A general description is presented concerning atomic particles and natural radioactive decay; a discussion is given of the basic principles of physics and the operation of the atomic pile. The effects of the atomic bomb explosion on the human body may be classified as: (1) acute effects lasting from one

day to six weeks and resulting in hemorrhage, anemia, leukopenia, and infections which do not heal, or (2) chronic effects which last from several weeks to several years. Other related topics are briefly considered.

4734 Modifications of Glycemia Under the Influence of Total X-ray Radiation. Marguerite Lourau and Odette Lartigue. Compt. rend. 230, 1426-8(1950) Apr. (in French).

In previous work (Experientia 6, 25(1950)) it was shown that total body x-irradiation causes modifications of glucose metabolism; this paper is a presentation of the results of experiments to determine the extent of the modifications with fasting and with high saccharose intake. Two groups composed of 13 guinea pigs each, were irradiated in one dose calculated to deliver 500 r/animal; the blood glucose levels were determined at varying intervals for periods up to 35 days. It was shown that the hyperglycemia occurring after the ingestion of saccharose by animals, after 14 and 48 hr fasts, is significantly increased by the radiation dose given, and that there is a large decrease in glucose tolerance due to the irradiation, since it was found that the hyperglycemia was much more extreme in the animals irradiated 12 and 14 days before a dose of 1 g of saccharose than in nonirradiated animals. The authors conclude that the importance of the two effects is not equal, although they apparently arise from the same phenomena.

4735 The Modification of Resistance to Ionizing Radiation by Humoral Agents. J. B. Graham and R. M. Graham. Cancer 3, 709-17(1950) July.

Methods of modifying resistance to radiation in animals are reviewed. Experiments on Swiss mice exposed to total-body x-ray radiation are recorded. A number of substances including horse serum, stilbestrol, estradiol, estrone, testosterone, and adrenal cortical extract given either 10 days before or immediately after exposure to x-rays were found to increase or decrease the mortality rate. The effect produced was determined not only by the substance but also by the time of its administration. The ability of the hormones to modify radioresistance could not be correlated with their established endocrine activity. The sensitivity of animals to ionizing radiation was reflected in the appearance of their epithelial cells. Characteristic cytological alteration was observed in vulnerable animals after exposure. Experiments here and elsewhere indicate that the adrenal cortex has little to do with resistance to radiation. A variety of substances, including stilbestrol and some steroids, have been found to induce a cellular response in animals closely resembling that produced by radiation. This suggests that these materials and radiation have a similar effect on the organism and may explain the ability of these agents to modify resistance to radiation. 37 references. (auth)

4736 Partial Breakage of Salivary Gland Chromosomes. B. M. Slizynski. Genetics 35, 279-87(1950) May.

Low dosage x-ray treatment (400 to 600 r units) of Drosophila melanogaster embryos when applied in early developmental stages produces in the salivary gland chromosomes partial structural changes affecting only a few of the chromonemata of which the chromosome is composed. Partial structural changes include deficiencies, inversions, translocations and ring chromosomes; partial structural changes may also appear in mutual combination. Structural changes in which a few fibrils are thus separated in vivo from the remaining mass of the chromonemata form confirmatory experimental evidence of the polytene nature of salivary gland chromosomes of Diptera. 13 references. (auth)

BIOLOGY AND MEDICINE

4737 Physiological Genetics. D. G. Catcheside. Ann. Rev. Physiol. 12, 47-70(1950).

This article reviews those aspects of the field which present a knowledge of how the gene is constituted, reproduces, and controls development and differentiation. It covers the period from 1947 to 1949. Mutations produced by x-rays and radioactive phosphorus and evidence on the killer characteristics of paramecium obtained by the use of x-rays is discussed. 130 references.

4738 Radiant Energy. Abraham Edelmann. Ann. Rev. Physiol. 12, 27-46(1949).

This article is a general review of the field in biology and medicine covering the period from July 1, 1948, to June 30, 1949. Some of the topics discussed are the measures to protect personnel handling and exposed to radioactive material or x-rays and the action and effect of ionizing particles on various tissues, organs, and blood. 172 references.

4739 Radiation Damage to the Genetic Material. II. Effects Manifested Mainly in the Exposed Individuals. H. J. Muller. Am. Scientist 38, 399-425(1950) July.

This article reviews some of the more recent work in the field. Some of the topics discussed are the induction of gene mutations in somatic cells, chromosome breakage by radiation, and its effects, the validity of the distinction between gene and chromosome changes, factors predisposing to the production of chromosome changes, the accumulation of radiation damage to the individual emphasizing the risk of repeated, low dosage exposures, and the danger of using what are normally considered reliable criteria, such as change in blood count, loss of sperm mobility, reddening of the skin, and loss of hair in estimating radiation damage to an individual, and other biological effects of radiation, such as the inhibition and regression of mitosis caused by low doses and the influence of certain chemicals on the damage of biological material by radiation.

4740 Some Cytological Observations of X-ray Action on Triticum Monococcum. Alberto Gardé. Argonomia Lusitana 10, No. 1, 25-73(1948).

The author makes a survey of the literature dealing both with natural and artificial radiations and their genetic and cytological effects. The importance of the use of x-rays together with other agencies is discussed, putting special emphasis on chemical substances. The writer in his experiments used lead acetate before x-irradiation. He concluded that: (1) Lead acetate per se, leads only to agglutination and total or partial dissolution of the matrix substance. (2) The supplementary treatment of Triticum monococcum root-tips with 1% aqueous solutions of lead acetate decreases the total percentage of chromosomic aberrations due to x-rays. Fragment percentage decreases, whereas translocations percentage is not affected or very slightly increased. (3) The main effect of the secondary radiation of lead submitted to x-rays seems to be mutagenic. Different cases of chromosome aberrations are described (delay of division after treatment, cells with an abnormal number of chromosomes,

tri- and tetrapolar spindles, fragments, dicentric chromosomes, anaphase bridges, etc.). From these observations the writer concludes that: (1) The type of dicentrics with the two centromeres very near one another seem to be more persistent than any other throughout cell division. The writer thinks that perhaps the closeness of the two centromeres may produce an effect leading to their behavior as a single element. (2) Resistance of the chromosomes of Triticum monococcum L. to x-rays seems to be different for different pairs. SAT chromosomes are the most resistant. (3) The centromere plays a very important part in chromosome reaction to x-rays. 113 references. (auth)

4741 Some Recent Findings in Radiobiology. Arne Forssberg. Strahlentherapie 81, 161-72(1950)(in German).

This is a review of some of the experimental work done recently on the fundamental phenomena of radiobiology. The dependence of mutation frequencies on the dose in the small-dose region, the chemical changes produced by radiations in the chromosomes, the part played by the solvent in a radioreaction, the effects of very small doses, are some of the subjects discussed. 18 references.

4742 Studies on Lymphocytes from Persons Treated with Radioactive Iodine. William E. Watts, and Don R. Matheson. J. Lab. Clin. Med. 35, 885-9(1950) June.

A study was made to determine whether the number and frequency of refractile cytoplasmic granules known to be present in 34% of the normal lymphocytes increase on exposure of the host to ionized radiation. Samples of blood were obtained from the capillaries of two patients with cancer of the thyroid and from eight patients with exophthalmic goiter before the administration of therapeutic doses of I^{131} and at varying intervals thereafter. Further control studies were made on blood from normal persons and from patients with other diseases. Samples were also taken from three technicians who had been exposed to irradiation for 8 to 27 years and from four patients who were receiving massive doses of x-rays in the treatment of malignant diseases. The number of refractile granules in each sample of blood were counted. A significant change in the number or frequency of the refractile granules in lymphocytes from persons exposed to ionized irradiation was not found. A search was made for other concise or specific qualitative cytologic effects of irradiation, but none was found. The refractile granules were found to be best studied in fresh, unstained preparations by phase microscopy. (auth)

4743 The Tetrazoles as Indicators of Radiation Damage. Z. S. Gierlach and A. T. Krebs. Army Medical Department, Jan. 3, 1950. 14p. (AEC File No. NP-1419.)

Plant seeds irradiated with x-rays and then treated with tetrazolium salts show that the irradiation effect can be detected by changes in the reducing power of the enzyme systems and can be measured by the amount of colored formazan formed. The relation between dose and irradiation effect on the reducing systems can be written in exponential functions with a constant characteristic for the proper enzyme systems. The environment is of great importance. The radiation effect is altered when seeds are irradiated in the wet or dry states, when different pH values are used, or upon pre- or post-treatment with various chemicals, etc. The tetrazolium salts used were 2,3,5 triphenyl tetrazolium chloride, 2,3 diphenyl-5-methyl tetrazolium chloride, and neotetrazolium. 29 references.

4744 Xenia Effects of Irradiating Corn Pollen in a Nuclear Reactor. E. F. Frolik and Rosalind Morris. Agronomy J. 42, 293-7(1950) June.

Xenia effects in corn crosses involving tassels irradiated in a nuclear reactor were determined in comparison with crosses involving x-rayed and nonirradiated tassels. Irradiations were made in the thermal neutron column of the heavy water pile at the Argonne National Laboratory for periods of 0.5, 1, 2, 4, 8, and 16 min, respectively. The x-ray dosage consisted of 1200 r units. In general, the percentage of entire mutations increased with increase in length of time of exposure in the nuclear reactor. The effectiveness of pile radiation varied markedly with date of treatments. There was considerable uniformity in the response of individual plants to comparable irradiation treatments. The effectiveness of x-ray treatment varied somewhere between 0.5 min and 4 min of pile irradiation, depending on date of treatment and on the character involved. The percentage of mutations for both sources of radiation varied for the characters under study in the following decreasing order of frequency: (a) defective kernels, (b) colorless aleurone, (c) sugary endosperm, and (d) red aleurone. The frequency of chimeras was affected far less than that of entire mutations by the pile radiations. No association was apparent between frequency of recoveries and either pile radiation or x-radiation. No qualitative differences between the two types of radiation were noted in these tests. 13 references. (auth)

4745 Decontamination of Buildings by Flame. R. C. Heatherton. NYO-1513, May 1, 1950. 5p.

An oxygen-acetylene blow torch was found to have certain advantages in the radioactive decontamination of structural concrete (principally floors) in a dismantled uranium processing plant. It was tried on other building materials with varying degrees of success. (auth)

4746 Attack of Hypertension Following Plesiotherapy of a Lingual Neoplasia. Giandomenico Botti. Radioterapia, radiobiologia e fisica medica 2, 253-7(1949) (in Italian).

A grave attack of hypertension followed a successful plesioroentgenological treatment of a neoplasia of the tongue in a hypertensive patient. The author interprets the case as due to blocking of the carotid body which was included within the irradiated region. The blocking that probably occurs when the ray dose reaches a certain value produces a temporary inhibition of the functions of the carotid body. The total dose, distributed on three fields, was 8250 r. (auth)

4747 The Effect of Rutin on Capillary Fragility and Permeability. C. T. Frericks, I. G. Tillotson, and J. M. Hayman, Jr. J. Lab. Clin. Med. 35, 933-9(1950) June.

No change in the capillary fragility (as measured by positive and negative pressure methods), in capillary permeability, in retinal hemorrhages and exudate, or in petechiae was detected in ten patients with diabetes mellitus and six hypertensive subjects given 180 mg rutin daily for one to three months when compared with similar patients given a placebo. 36 references. (auth)

BIOLOGY AND MEDICINE

4748 Individual Fluctuations of the Threshold of Erythema and of the Latency Period and Duration of Early Erythema Produced at the Radiation Threshold. Roderich Helmke. Strahlentherapie 81, 117-22(1950) (in German).

Experiments were carried out on 100 persons with healthy skin to determine the threshold, latency period, and duration of erythema produced by irradiation with x-rays (9 kev, 10 ma, 10 cm target distance.) The experimental material was characterized by great fluctuations. The threshold was found to range from 200 r to 300 r, the latency period from 3 to 20 hr, and the duration from 1 to 20 hr.

4749 Osteoradionecrosis of the Jaw. Claude S. LaDow. Oral Surg. Oral Med. Oral Pathol. 3, 582-9(1950) May.

Osteoradionecrosis frequently follows irradiation therapy for neoplasms of the oral cavity. This disease results from: intensive x-ray or radium therapy which interferes with normal bone nutrition; trauma which leads to bacterial invasion of the underlying connective tissue structures; or, infection of the jawbone from oral flora, which are resistant to therapeutic measures. Treatment should be limited to control of pain, to the maintenance of oral hygiene, and to general supportive measures until such time as surgical intervention is found justifiable to eradicate all diseased bone. In conclusion, it is strongly recommended that prior to irradiation for malignant tumors all teeth within the site of irradiation be extracted; partial aveolectomies may be necessary to remove areas of peripherally sclerosed bones; the mucous membrane should be approximated over exposed alveolus. (auth)

4750 Safety Factors Required for Radium-Containing Static Eliminators. K. E. Corrigan, H. S. Hayden, and J. O. Reed. Harper Hospital Bull. 7, 216-17 (1949) March-April.

This article appeared in the J. Michigan State Med. Soc. 48, 1279-1282 in October of 1949. An abstract of the article has been listed in Nuclear Science Abstracts as abstract 3-2094.

4751 Some Critical Remarks on Epilation of the Scalp by X-rays. Gastone Meldolesi. Radiologia 5, 291-302 (1949)(in Italian).

On a group of children infected with the ringworm of the scalp, determinations were made, before and after the epilation by x-rays, of the lumbar-fluid pressure, of the glycorrhachia, of the albuminorrhachia, and of the presence of the nitric ion in the fluid and in the blood. The results point to a congestion of endocranial tissues, with persisting hemato-fluid barrier. It is concluded that, for very young children, the therapy combining thallium acetate with x-rays should be used more frequently than has been done. (auth)

4752 Use of Anticoagulant (Dicumarol) in Preventing Post-Irradiation Tissue Changes in the Human Lung; Preliminary Report. Stanley H. Macht and Harry Perlberg, Jr. Am. J. Roentgenol. Radium Therapy 63, 335-41(1950) Mar.

A report is presented on the diminution of radiation effects (inflammatory changes, resulting in lung fibrosis, and thrombosis and fibrosis of small lung blood vessels) in the lungs secondary to the successful irradiation of esophageal and lung carcinoma; one case is presented in detail and the results of eight more cases are appended. The patient, colored, male, and 64 years old, was shown to have squamous cell carcinoma of the middle third of the esophagus and was treated with x-ray therapy after a gastrostomy. Ten portals, each measuring 6.5 by 16 cm, were irradiated, two daily at a tumor dose of 100 r to each; a 200-kv machine was used with a Thoraeus filter at a target distance of 50 cm. Treatment was continued for a total of 17 days; minor symptoms of radiation sickness, which developed on the sixth day, were relieved by the administration of 50 mg of pyridoxine 1 hr before and 1 hr after each treatment. Increased prothrombin time was maintained throughout the therapy by means of dicumarol; an attempt was made to hold the time within 10 to 30% of normal. The patient died before more than half of the contemplated x-ray dosage could be given, but upon autopsy, it was noted that the radiations had destroyed almost all the tumor without producing any undesirable radiation effects; the latter phenomenon is attributed to the administration of the dicumarol. In the cases appended to the article, total dosages of 6000 r for carcinoma of the esophagus and 5000 to 8000 r for carcinoma of the lungs were delivered while dicumarol was administered. Radiation symptoms were absent in these cases, due, the author concludes, again to the dicumarol.

4753 Will We Be Poisoned by Atomic Wastes? Maurice E. Nahmias. Science et Vie, 89-92(1950) Feb. (in French).

The author describes the problems involved in protecting personnel and local communities from the radioactive materials and wastes handled in large-scale nuclear research establishments. In particular he discusses methods of determining safe dosages of various types of radiation, methods of shielding nuclear piles, and the difficulties which may eventually arise from the disposal of diluted atomic wastes in underground containers.

4754 Working Drawings of Tools for Handling Radioactive Sources. A. Morrison and K. J. Parry. National Research Council of Canada Report No. NRC-2025, nd. 50p.

Detailed working drawings are given for tools, the purpose of which is to use distance as a protective factor in handling radioactive materials which emit β and γ rays. Each tool provides for about a meter of separation between the active source and the hand carrying the tool. The mechanical design has been kept as simple, reliable, and positive, as seemed possible. These were designed for the handling of Co^{60} sources enclosed in aluminum cylinders about 0.75 in. in diameter and 1.71 in. long.

4755 Cancer of the Thyroid: Ten to Twenty Year Follow-Up. Hugh F. Hare and Ferdinand A. Salzman. Am. J. Roentgenol. Radium Therapy 63, 881-8(1950) June.

The history and histopathology of 198 cases of cancer of the thyroid are presented. A total of 49 cases of alveolar adenomas with invasion were removed surgically and were given additional postoperative x-ray therapy, which consisted of approximately 6000 r measured in air, delivered through three portals in 21 days by a 200-kv machine at a target distance of 50 cm and filtration of 1 mm Cu and 1 mm Al; there was no evidence of recurrence in these cases. A total of 48 cases of papillary adenocystoma with invasion were treated surgically, and in cases in which there was invasion of the trachea and muscles x-ray therapy, consisting of 6000 r in air, prevented recurrences; papillary adenocarcinoma cases

(a total of 38 patients) were treated similarly. Of a total of 24 cases of alveolar adenocarcinoma cases, most of the patients who survived received radium therapy in addition to the x-ray therapy and surgery; 6000 to 11,000 γ-r were delivered. Small cell carcinoma cases (30 patients) responded to irradiation following surgery; giant cell carcinoma cases were relatively insensitive, and if a recurrence after surgery was seen the particular case was labeled as hopeless. Surgery was the main therapeutic measure relied upon in all the cases discussed here. The five-year survival rate varied from 77.5% for the fetal adenoma cases with invasion to only 20.2% for the small cell carcinoma cases.

4756 Chemistry of Neoplastic Tissue. E. Boyland. Ann. Rev. Biochem. 18, 217-42(1949).

This article is a review of recent work in the field based on a thorough compilation of the literature. Included are the treatment of cancer by radioisotopes (P^{32} and I^{130}), the cancer producing properties of radioactive fission products (plutonium and Y^{91}), the inhibition of skin cancer due to radiation by the use of chemicals, and the effect of cosmic radiations on carcinogenesis. 170 references.

4757 Clinical Course of Two Hundred Cases of Angina Pectoris Treated with Roentgen Irradiation of the Adrenals (1937-1947). W. Raab. Am. J. Roentgenol. Radium Therapy 63, 895-901(1950) June.

Two hundred patients with angina pectoris were treated between 1937 and 1947 with roentgen irradiation of the adrenals (57 of the cases also with irradiation of the cervical and upper thoracic spine). Clinical improvement of all degrees, beginning on an average four weeks after the respective series of treatments and lasting for an average of 31 months, was reported by 152 patients; maximum improvement (complete or almost complete freedom from symptoms) was reported by 63, lasting for an average of 43 months. Complete permanent relapses were reported in 23%, nonfatal myocardial infarctions in 6% of the improved cases. Death occurred in 32% of all cases and little indication of a life-prolonging effect of the treatments was obtained, cases of long standing and with angina decubitus seem somewhat more likely to fail to respond than others. 29 references.

4758 Contact Radiotherapy in Epitheliomas of the Oral Cavity. J. Papillon, A. Dardaillon, and J. Lacorre. J. Radiol. Electrol. 31, 197-8(1950)(in French).

A total of 11 epitheliomas of the oral cavity were treated by radiotherapy, 6 of which were baso-cellular and 5 of which were spino-cellular; all were followed for at least two years after therapy. No filtration was used and a total of 5200 to 9300 r were delivered per field; 7 of the cases were treated in a single sitting, and most of the cases were irradiated through a single field (2 were treated through 3 to 4 fields). A cutaneous reaction was in all cases noted; it was exudative and prolonged. Ten cases were cured, while in one case there was a small recidivation.

4759 Depth Dose Curves for Treatment Grids in Radiotherapy. Robert Loevinger and Wilbert Minowitz. J. Mt. Sinai Hosp. N. Y. 17, 49-52(1950) May-June.

A method is described in this report for the determination of the correct depth dose information relating to the grid technique of administration of x-ray therapy; it consists of deriving by certain calculations the necessary data from conventional depth dose tables.

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4760 Direct Measurement of the Dose of X-rays to the Pituitary of the Cadaver for Usual Roentgentherapeutic Situation. A Folichon, A. Ennuyer, M. Bertoluzzi, and R. Calle. J. Radiol. Electrol. 31, 170-4(1950)(in French).

The authors derive values for the effective percentage dosage delivered to the adult pituitary gland from different ports of entry. The ports discussed are the anterior frontal, temporal, maxillary, superior frontal, and occipital. The authors state that if the anthropometric characteristics of the cranium of the particular patient are not very different from those described in these studies, the radiologist will be able to use the standard isodose curves as modified by the absorption presented for the different ports of entry. The results obtained are not to be applied when patients are infants or adolescents, since other absorption values are present due to different tissue, bone matter and distance relationships; the authors state that the transmission values in these cases approach very well the standard isodose figures. This material presented may in the future be used to calculate the effective tumor-dose in cases of cerebral tumors.

4761 Eosinophilic Granuloma with Simultaneous Involvement of Skin and Bones. James H. McCreary. Arch. Dermatol. and Syphilol. 58, 372-80(1948) Oct.

A case of eosinophilic granuloma with calvarial bone defect and cutaneous ulceration is reported in detail; the differential diagnosis of Hodgkin's disease, eosinophilic granuloma of the bone, granuloma of the skin, Letterer-Siwe disease and Hand-Schüller-Christian disease is discussed. The lisions showed good response to bone curettage, local roentgen radiation of 500 to 1800 r per lesion (in fractionated doses delivered by a 130-kv machine, at a focal distance of 50 cm, with no filter), and injections of a total of 2200 μc of P^{32} (given intravenously in two courses, with a daily dose of 200 to 300 mc). An addendum reports that two lesions recurred and one other appeared.

4762 Four Years of Contact Radiotherapy; Contact Radiotherapy. M. Bourrel. J. Radiol. Electrol. 31, 195-7 (1950)(in French).

The results of the treatment of a number of benign and malignant cutaneous lesions with contact radiotherapy are presented; warts of the plantar region, the hands and other areas, naevi and angiomas, malignant cutaneous lesions and endo-cavitary tumors are discussed. A Philips contact x-ray machine operating at 50 kv was used. Plantar warts received about 4500 r through a 1-mm Al filtration and in 90% of the cases rapid disappearance of the warts took place; warts of the hands received fractionated doses for a total of about 3000 r delivered in 4 to 6 weeks, and good results were obtained; other areas containing warts were treated with 3000 to 4500 r with excellent results. Naevi and angiomas were treated with 600 to 1200 r through multiple fields, one field being treated per session; at the moment regressions are in evidence; other lesions were treated similarly. A total of 12 cases of epithelioma of the face were also treated; 8 cases were treated by a single dose of 4500 to 6000 r and 4 cases were treated with fractionated

doses for a total of 3000 to 4500 r. In conclusion, good results were obtained by the described method.

4763 Goiter and Thyroid Pathology in Belgium. Therapy of Thyrotoxicosis. Lucien Brull. Rev. Med. Liege 5, 353-7(1950) July 1 (in French).

Nine cases of Basedow's disease were treated with doses varying from 10 to 23 mc of radioiodine (I^{131}). Seven patients were completely cured, two improved. No treatments failed completely, nor were any complications resulting from the treatments observed. (auth)

4764 A New Approach to the Roentgen Therapy of Cancer with the Use of a Grid (Preliminary Report). Hirsch Marks. J. Mt. Sinai Hosp. N. Y. 17, 46-8(1950) May-June.

A report is presented on the results of the treatment of three cases of cancer with the x-ray therapy grid technique. Grids employed in the method were perforated sheets of lead rubber with square apertures ranging from 0.25 cm^2 to 4 cm^2. Unusually large doses of x-rays measured in air were delivered by means of this method and the cases demonstrated a good early response. In spite of the large doses, the skin areas healed completely with only slight atrophy and in each case there was a clinical disappearance of the underlying tumor.

4765 Radiation Versus Surgery for Cancer of the Tongue. George S. Sharp, Eugene W. Demaree, and Robert E. Pugh, Jr. Western J. Surg. Obstet. Gynecol. 58, 257-70(1950) June.

The results of the treatment of a number of cases of cancer of the tongue with radiation therapy are presented. The symptomatology, method of classification, frequency of a metastatic cervical node involvement, and the methods of treatment of the primary lesion and the metastatic cervical nodes are topics which are discussed in detail under separate headings. Stage 1 cases were treated by surgical excision or radiation therapy; stage 2 and 3 cases were treated mainly by radiation therapy; and, stage 4 cases, comprising growths which had invaded beyond the limits of the tongue, were treated by surgery. Peroral x-ray therapy consisted of daily doses of 400 r delivered at 200 kv through filter equivalent to 2.0 mm Cu; total doses were 4000 to 4800 r. Interstitial radium needle therapy delivered about 450 to 500 mg hr total dose to the stage 1 lesions and about 1800 to 2000 mg hr to the stage 2 primary growths. Of 41 cases followed for over five years, 37% were free of recurrences of the disease; the remainder died of the disease or were not traced. Of 43 cases treated since 1944, 40 primary lesions were treated by the combined peroral x-ray therapy and interstitial radium needles with only one local recurrence; three patients were incurable because of massive primary lesions or inoperable cervical metastases. 26 references.

4766 Radioactive Iodine in the Treatment of Hyperthyroidism. John E. Kearns and William F. Hutson. Quart. Bull. Northwestern Univ. Med. School 24, 107-10(1950)

A report is presented on the results of the treatment of 21 cases of hyperthyroidism with I^{131}. The average dose administered was 7.2 mc, the smallest dose was 2.5 mc, and the largest dose was 20 mc. Five patients required more

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than one dose of the isotope, and the highest number of doses given to any patient was four. One patient developed hypothyroidism after a relatively small amount. The average fall in the basal metabolic rate following the isotope therapy was over 50%; there was a sustained fall of over 60 beats per minute in the pulse rate. All patients have had satisfactory remissions for at least 12 months. Some of the problems and complications seen with this type of therapy are discussed. The authors feel that this method is another satisfactory way of treating hyperthyroidism, and one which carries no mortality, morbidity, or hospitalization for the patient.

4767 Radioiodine in the Management of Thyrocardiac Disease. Saul L. Fox. Ann. Western Med. Surg. 4, 282-5(1950) June.

Five cases of thyrocardiac disease are presented, four of which are examples of pure thyrocardiac disease relieved by successful treatment of the thyrotoxicosis with radioiodine; the fifth case presents thyrocardiac disease complicating organic heart disease (hypertension and rheumatic mitral stenosis) which was ameliorated but not completely eliminated following the radioiodine therapy. Total doses of 3.7 to 10 mc of I^{131} were delivered in fractionated amounts. The use of radioiodine is also discussed in relation to the diagnosis of thyrocardiac disease. Cardiac disorders, particularly the arrhythmias, are often associated with thyrotoxicosis, and in such instances, restoration of normal thyroid function may relieve the heart condition. The author concludes that unless definite contraindications are present, every attempt should be made to correct an arrhythmia, regardless of its duration, in a patient with thyrocardiac disease. (auth)

4768 Radiological Treatment of Venereal Tumors in Dogs. Nanta, Baseik, Marquès, Bru, Laserre, and Puget. J. Radiol. Electrol. 31, 167-8(1950)(in French).

A curious dog disease, spreading in the South-West of France (1611 cases reported in 1948) and transmitted through the sexual act, is characterized by polypous tumors of the mucosae of the glans penis and the vulvo-vaginal region, and is accompanied by purulent discharges; adenopathies are occasionally observed, while generalizations are rare. At one time considered a sarcoma, the polyp is more probably a reticular monocytoma analogous to a mycosis of man. The authors established the high radiosensitivity of the affection and devised a successful treatment, a 400-r homogeneous dose at the tumor, (repeated after a three-day interval), being generally sufficient; in generalized cases the irradiation of the whole body by a total dose of 300 r (in 25-r doses every two days) is applied. The number of animals treated and healed was 54.

4769 Results of Radiotherapy in Primary Cancer of the Vagina. V. Kahanpää and T. Gylling. Ann. Chir. Gynacol. Fenn. 38, 164-74(1949).

Of 24 patients treated during the years 1937-1942, the relative survival rate was 50% and the absolute 36%. The dosage of radium was 4915 mg element hr on an average, and the roentgen dose was 4650 r on an average. Two rectovaginal fistulas were detected later. Radiotherapy was evidently better treatment than radical operation.

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4770 Roentgenotherapy of the Tumors of the Ovary. M. Guttadauro. Radiologia 5, 303-16(1949)(in Italian).

The present state of the question on the applicability of x-rays in the treatment of malignant tumors of the ovary is discussed. Twelve cases of such a treatment are described and, taking into consideration the existing literature data, it is concluded that a roentgenotherapy of ovary tumors should be subordinated to a surgical intervention. The effects of the irradiation are more beneficial, the earlier and more radical the surgical treatment has been and the sooner the irradiation followed the operation. In inoperable cases roentgenotherapy is essentially a palliative. (auth)

4771 Some Results from the Use of Radioactive Iodine, I^{131}, in the Diagnosis and Treatment of Toxic Goiter. Sidney C. Werner, Lawrence D. Goodwin, Edith H. Quimby, and Charlotte Schmidt. Am. J. Roentgenol. Radium Therapy 63, 889-94(1950) June.

The results are presented of a study in 175 hospital patients, to compare the radioactive iodine tracer technique with the basal metabolism test in routine clinical use. It is suggested that the tracer technique provides an exclusion test for thyroid dysfunction of greater objectivity and accuracy than the basal metabolism. The results of treatment of hyperthyroidism with radioiodine, I^{131}, in 103 patients, are summarized; doses of 3 to 6.5 mc were given. A very high remission rate (90%) has been obtained. The complications and disadvantages are discussed. (auth)

4772 Statistical Observations on Radium Therapy of Neoplasmas of the Uterus. Part I. Previous Physiological and Pathological History of the Patients. G. F. Gardini and D. Agostini. Tumori 23, 23-31 (1949)(in Italian).

A statistical study was made of 1404 cases of epithelioma of the cervix of the uterus, 92 cases of carcinoma of the body of the uterus, and 107 cases of fibroma, that have been treated at the Radium Institute of the University of Bologna, Italy, in the period 1930 to 1936. In this first part of the work, physiological and pathological data, prior to the appearance of the symptoms of the disease, are tabulated. These data concern menstruation, pregnancy, parturition, venereal diseases, and hysterectomy.

4773 Technical Aspects of a Standardization of Radium Tubes and Needles. Von Gorup. Strahlentherapie 81, 359-64(1950)(in German).

Types of radium tubes, needles, and applicators, in use in Europe and America, are surveyed and the problem of standardization is discussed. It is also suggested that the isodose charts for applicators be more accurately prepared than has been done.

4774 Technical and Statistical Aspects of the Radium-Roentgenotherapy of the Inoperable Cancer of the Rectum. R. Camerini and B. Bertiglia. Arch. ital. malattie apparato digerente 15, 391-404(1949)(in Italian).

On the basis of 75 cases of inoperable cancer of the rectum, cured by radium-roentgenotherapy, a statistics was established taking into account anatomo-clinical aspects of the case, long-term results and technical characteristics of the treatment. The fact that the patient was alive five years after treatment, with no relapse or metastases during that period, is taken, in accordance with many writers, as a criterion of cure of the cancer of the rectum. Results: radiation treatment of inoperable and never operated tumors furnished 7% cured cases; death within the 5-yr period followed radiation treatment of all cases of post-operative relapse. (auth)

4775 The Removal of Uranium Compounds from Cloth. A. B. Carlson and William F. Neuman. UR-108, nd. 13p.

This paper is a summary of a thesis entitled "The Removal of Uranium Compounds from Cloth, A Laundry Problem", by A. B. Carlson. Experiments were undertaken to develop an efficient, yet economical means of rendering clothing contaminated with uranium hazard-free. It has been shown that uranium was adsorbed by cloth fibers, presumably by a process of cationic exchange. This adsorbed material was not removed by ordinary laundry methods; the presence of some complexing agent was required. The cheapest effective agent was found to be sodium bicarbonate. Clothing washed in a reasonable volume of water (with or without soap) containing sodium bicarbonate (>0.03%) and a suitable oxidizing agent can be considered toxicologically "safe." 10 references.

4776 Biochemical Studies of Toxic Agents. 1. Experiments with Radioactive 2:3-dimercaptopropanol (British Anti-Lewisite). S. D. Simpson and L. Young. Biochem. J. 46, 634-40(1950) May. (See also NSA 4-2965.)

A description is given of the synthesis of 2:3-dimercaptopropanol (BAL) with radioactive sulphur (S^{35}) incorporated in the molecule. The absorption, distribution, and excretion of S^{35} have been studied following the administration of radioactive BAL to rats by application to the skin or by intramuscular injection. When radioactive BAL is applied to the skin of the rat it is absorbed slowly; the S^{35} which is absorbed is distributed throughout the organism and most of it is excreted in the urine within the following 24 hr. When radioactive BAL in propylene glycol is administered to rats by intramuscular injection, the S^{35} passes almost completely from the dosed muscle in 6 hr. Radioactive material is present in most of the tissues 6 hr after the injection. A large proportion of the S^{35} is excreted in the neutral sulphur fraction of the urine in the 24 hr following the injection of radioactive BAL. (auth)

4777 Kidney. J. Trueta. Ann. Rev. Physiol. 12, 369-98 (1950).

The author reviews the progress in the field from January to December 1948. The interference uranyl salts offers to the function of the proximal convolution of the nephron and the renal lesions caused by beryllium poisoning are mentioned. 190 references.

4778 Subcutaneous Beryllium Granuloma. Seymour B. Silverman and Cyrus C. Erickson. Arch. Path. 50, 63-7(1950) July.

A case of subcutaneous beryllium granuloma with a history of skin laceration by a fluorescent light tube is presented. The remarkable similarity in histologic appearance of the beryllium granuloma and Boeck's sarcoid is emphasized. (auth)

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4779 Toxic Effects of Beryllium. Harriet L. Hardy. Trans. Natl. Safety Congr. 18, 23-6(1949).

The hazards of beryllium in industry are discussed.

4780 Absorption and Excretion of the Mono-sodium Salt of Thyroxine Labeled with Radioactive Iodine. J. C. Clayton, Audrey A. Free, J. E. Page, G. F. Somers, and E. A. Woollett. Biochem. J. 46, 598-604(1950) May. (See also NSA 4-1356.)

Single doses of the monosodium salt of DL-thyroxine labeled with radioactive iodine in the 3′- and 5′-positions were administered either in solution or as a suspension, orally or subcutaneously, to rats; the subsequent excretion in urine and feces was determined over a 4-day period. The final distribution of radioactive iodine in the carcass was studied. It was shown that the thyroxine in solution and as a suspension is metabolized in the same way and that it is absorbed from the gastrointestinal tract. The radioactive iodine in the urine was present almost entirely as iodide, whereas that in the feces was present in both organic and inorganic forms. Single physiological doses of labeled monosodium DL-thyroxine were administered intraduodenally, subcutaneously, or intravenously to anesthetized cats; the subsequent radioactive iodine blood levels and urinary and biliary excretion rates were measured over a 6-hr period. The distribution of labeled thyroxine and its breakdown products was studied. For all routes of administration, the amount of radioactive iodine in the bile was related to the blood concentrations; that in the bile was present in approximately equal proportions as thyroxine and iodide. Appreciable amounts of iodine were secreted into the stomach. Rat thyroids, in contrast to cat thyroids, contained appreciable quantities of radioactive iodine; very little of the radioactive iodine in the rat thyroids was present as thyroxine. 39 references. (auth)

4781 Annual Review of Biochemistry, Vol. XVIII. J. Murray Luck, Hubert S. Loring, and Gordon MacKinney, Eds. Stanford, Calif., Annual Reviews, Inc., 1949. 739p.

The progress made in the various fields of biochemistry during the last few years is reviewed. Those fields in which tracer techniques have been used are abstracted separately. Extensive bibliographies are included.

4782 Annual Review of Physiology, Vol. XII. Victor E. Hall, Jefferson M. Crismon, Arthur C. Giese, Eds. Stanford, Calif., Annual Reviews, Inc., 1950. 609p.

This book has selected articles which review the progress made in the various fields of physiology during the past few years. Those fields in which tracer techniques have been used or which discuss the effects of radiation on living matter are abstracted separately. An entire chapter is devoted to various aspects of radiant energy. Extensive bibliographies are included.

4783 Application of Radioisotopes to a Comparative Study of Calcium and Phosphorus Metabolism in the Laying Hen. J. B. O'Neil, and J. W. T. Spinks. Chemistry in Canada 2, No. 6, 23-25(1950) June.

Hens were fed salts containing radioactive calcium or phosphorus and a check for radioactivity was made in the shell, white, and yolk of their eggs and in their excretions during successive days. More than 5% of the phosphorus fed as calcium phosphate appeared in the egg, with more than 80% of this being in the yolk. The calcium fed as $CaCO_3$ was a maximum (29%) in the shell of the second egg after feeding and then fell off rapidly in the shells of later eggs.

4784 Biochemical Applications of Isotopes. Victor W. Nowinski. Ciencia e invest. 6, 16-19(1950) Jan. (in Spanish).

This lecture states that the progress of a science is essentially a progress of methods and techniques. Isotopes are indicated to be in use in all branches of biochemistry for studying the following: (1) the identification and synthesis of organic compounds in the organism (this includes such substances as the enzymes), (2) enzymatic activities and their mechanism, (3) the distribution and metabolism of inorganic compounds, including problems concerning electrolytes, and (4) permeability. Brief references are made to uses of Pb^{212}, N^{15}, C^{14}, and C^{13}.

4785 Blood Gas Transport. Robert C. Darling. Ann. Rev. Physiol. 12, 265-88(1950).

The main part of this review deals with 3 stages in the transport of normal respiratory gases: (a) the equilibrium at the lung barrier, (b) the properties of blood as a carrier of gases, and (c) gas exchange in tissues. The period covered is from June 1946 to June 1949. The use of C^{14} labeled CO to check the disappearance rate of CO inhaled by turtles and mice and the extrapolation of the results to man is mentioned briefly. 283 references.

4786 Carbohydrate Metabolism. Harland G. Wood and Victor Lorber. Ann. Rev. Biochem. 18, 299-334 (1949).

This article is a review of carbohydrate metabolism confined chiefly to higher animals. The period covered is from October 1947 to November 1948. The use of C^{14} and P^{32} in the study of the reactions of anaerobic glycolysis, C^{13}, N^{15}, and C^{14} to study the triearboxylic acid cycle is reported. 215 references.

4787 Chemistry of the Hormones. A. Wettstein and F. Benz. Ann. Rev. Biochem. 18, 355-90(1949).

The authors review the research carried out in the field during 1948. Mention is made of the use of radioiodine to investigate iodine metabolism in the thyroid and C^{13} in the synthesis of 16-C^{13}-dehydroepiandrosterone acetate and C^{14} in the preparation of 17-(methyl-C^{14})-testosterone. References to extensive monographs on the chemistry and physiology of the hormones are included. 295 references.

4788 The Disposition of Radioactive Phosphorus in Normal, as Compared with Regenerating and Degenerating Nervous Tissue. David Bodian and Dominic Dziewiatkowski. J. Cellular Comp. Physiol. 35, 155-77(1950) Apr.

The distribution of phosphorus in inorganic, acid-soluble, lipid, and protein fractions of certain nervous tissues of the rhesus monkey was investigated, and the uptake of radiophosphorus in these fractions was subsequently studied. Gray matter was found to have high levels of acid-soluble P and low levels of lipid P as compared with white matter. "Residual P" (nucleoprotein and protein) was low in the caudate

nucleus ("pure" gray) and in peripheral somatic nerves, as compared with levels in corpus callosum, cerebral cortex, or spinal cord gray. Regenerating nerve (proximal stump of severed nerve) differed little in P content from normal nerve, except that "residual P" seemed slightly higher. Degenerating nerve (distal stump) contained reduced levels of acid-soluble P and lipid P, probably attributable to degeneration of axoplasm and myelin, respectively, and increased levels of "residual P," probably the result of Schwann cell proliferation. Analysis of the "residual P" fraction in terms of pentose nucleic acid (PNA) and desoxypentosenucleic acid (DNA), showed that caudate nucleus and corpus callosum contain equivalent amounts of nucleic acid, but the latter contains higher levels of protein P. However, the caudate nucleus has a PNA/DNA ratio of 1+, whereas the corpus callosum has a PNA/DNA ratio of about 0.5, perhaps due to a higher content of neuroglia nuclei. Uptake of radiophosphorus and turnover appear to be low in all P-containing fractions of normal nervous tissues. In contrast, regenerating nerve (proximal stump) and degenerating nerve (distal stump), about one week after nerve section, shows relatively much greater uptake of P^{32} in all P-containing fractions. This increase over normal is less marked, especially in the "residual P" fraction, one month after nerve section. Comparison of uptake of P^{32} in anterior horns of spinal cord, corresponding to normal and to regenerating nerve, revealed no difference, although cell body cytoplasm of regenerating axons was in a state of PNA depletion. The failure to observe a difference, however, could be the result of a low ratio of relatively active to inactive components of the anterior horn of the spinal cord. The bearing of these findings on the mode of outgrowth of regenerating axions is discussed. (auth)

4789 The Distribution of Radioactive Cobalt in Pigs. R. Braude, Audrey A. Free, J. E. Page, and E. L. Smith. Brit. J. Nutrition 3, 289-92(1949).

Physiological doses of radioactive cobalt were fed to two pigs for 6 weeks and the final distribution of radioactive cobalt in the carcasses was determined. The relative amounts of radioactive cobalt found in most organs or tissues were similar to those found by Comar and Davis (J. Biol. Chem. 170, 379(1947)) in a pig after a single oral dose of radioactive cobalt. The values for pancreas, liver, and bile were lower, and those for cartilage and long bone higher, than those recorded by Comar and Davis. 17 references. (auth)

4790 Distribution of Radioiodine in Erythrocytes and Plasma of Man. J. E. Rall, Marschelle H. Power, and A. Albert. Proc. Soc. Exptl. Biol. Med. 74, 460-1(1950) June.

To venous blood drawn from normal individuals there was added various amounts of labeled sodium iodide (NaI^{131}). The ratio of chloride content of the erythrocytes to that of the plasma was found to be 0.59, and the corresponding ratio for radioiodide was 0.67. The data indicate that a portion of iodide added to human blood is not freely diffusible and may be bound in some manner within the erythrocytes.

4791 Effect of Magnesium on P^{31} and P^{32} Partition in Muscle. H. B. Stoner. Am. J. Physiol. 161, 387-98 (1950) June 1.

The effect of Mg^{++} on the distribution of phosphate in the muscle of the rat has been studied with particular reference

to ATP by both chemical and isotopic methods. Magnesium anesthesia does not alter the rate of disappearance of P^{32} from the plasma, but it has a definite effect on the distribution of both P^{31} and P^{32} in the voluntary muscle. Under the influence of Mg^{++} the ATP content of the muscle is increased. This is mainly due to the elimination of muscular contractions during the killing of the animal. That this is not the whole explanation is seen when the magnesium-treated animal is compared with one in ether anesthesia where these movements are also eliminated. Under these conditions, the difference is still found and the P^{32} results suggest that part of the effect is due to a decrease in the utilization of ATP leading to the accumulation of high energy phosphate bonds in the ATP and phosphocreatine fractions of the muscle. The possible bearing of these results on previous work on the effect of Mg^{++} on the biological behavior of the adenine nucleotides is discussed. 28 references. (auth)

4792 Effect of Physical Factors on Radiosodium Clearance from Subcutaneous and Intramuscular Sites in Animals. Frederick R. Franke, Joseph B. Boatman, Robert S. George, and Campbell Moses. Proc. Soc. Exptl. Biol. Med. 74, 417-21(1950) June.

A study of the effect of physical factors on radiosodium clearance in dogs is reported. The average clearance rate in 25 control intramuscular injections was 59.4% activity remaining after 10 min. Decreases in intramuscular clearance rates were demonstrated with application of ice-salt mixtures, radiant heat, and pressure cuffs. The average subcutaneous clearance rate in 10 control studies was 75.8% activity remaining 10 min. This rate of clearance was increased with the addition of hyaluronidase. The clearance of radiosodium from a part does not appear as a straight line function when plotted and the calculation of per cent activity remaining per unit time is suggested as an expression for determination of clearance rates. The present study entirely supports the view of Kety that this technique is applicable to measure the effective circulation of a tissue and indicates the need for further study to quantitate the procedure for clinical application. (auth)

4793 The Effect of Varying Quantities of Inorganic Iodide (Carrier) on the Urinary Excretion and Thyroidal Accumulation of Radioiodine in Exophthalmic Goiter. Donald S. Childs, Jr., F. Raymond Keating, Jr., J. Edward Rall, Marvin M. D. Williams, and Marschelle H. Power. J. Clin. Invest. 29, 726-38(1950) June.

Persons with exophthalmic goiter were given repeated doses of radioactive iodine I^{131} with the stable carrier I^{127}. The results and conclusions are summarized below: The renal clearance or renal excretion rate of iodide in patients with exophthalmic goiter was not significantly altered by variations in the quantity of stable (carrier) iodide in the range of 0 to 2.0 g. The relative iodine-accumulating function of the thyroid in patients with exophthalmic goiter was not significantly altered in most instances by increasing the amount of stable carrier from 0 to 0.1 mg. Quantities of carrier more than 0.1 mg significantly reduced the relative iodine-accumulating function as measured by extrarenal disposal rate. Quantities of carrier iodide of the order of 1 mg reduced extrarenal disposal rate to euthyroid proportions in the majority of instances; 10 mg or more of carrier

in most cases reduced it to negligible proportions. After doses containing carrier iodide in the range 0.001 to 0.1 mg in vivo observations show that I^{131} progressively accumulates in the thyroid in a fairly smooth exponential manner. After doses of 10.0 mg or more of carrier iodide the curve of thyroidal I^{131} rises rapidly to a peak in 2 to 3 hr, and thereafter decreases rapidly in amount, paralleling the fall of radioactivity in serum. Doses containing carrier iodide between 0.1 and 10.0 mg result in curves which appear to be intermediate between these extremes. The thyroidal function portrayed with the use of small quantities of carrier iodide (0.1 mg or less) is considered to be predominantly the utilization of iodine in the biosynthesis of thyroid hormone. The thyroidal function disclosed with the use of large doses of carrier iodide is considered to be the concentration of inorganic iodide within the thyroid, called the iodide-trapping or iodide-concentrating function. The relative biosynthetic function appears to be suppressed by doses of iodide in excess of 0.1 mg in subjects with exophthalmic goiter. In these subjects, the iodide-trapping function may not appear to be altered with doses in the range 0.1 to 100 mg but may appear to be suppressed by doses of 500 mg or more. The relative biosynthetic function appears to be suppressed or obscured at a serum concentration of inorganic iodide of the order of 5 μg/100 cc or less; the capacity of the trapping function appears to be exceeded at serum concentrations of inorganic iodide or the order of 2 mg/100 cc. The iodide-trapping function of the thyroid can be evaluated in the human subject following high-carrier doses by comparison of the quantity of radioiodine in the thyroid with the concentration in the serum at the same time. The mean ratio of thyroidal content to serum concentration in 7 cases of exophthalmic goiter tested disclosed a mean thyroidal iodide space of 9.5 liters. The method here employed was not found suitable for accurate evaluation of the thyroidal iodide-trapping mechanism in euthyroid patients, which appears to be of the order of 1 liter, or less. 13 references. (auth)

4794 The Enzyme-Catalyzed Exchange of Ammonia with the Amide Group of Glutamine and Asparagine. Heinrich Waelsch, Phyllis Owades, Ernest Borek, Nathan Grossowicz, and Mogens Schou. Arch. Biochem. 27, 237-9(1950) June (Letter to the editor).

Glutamine, asparagine, and labeled ammonium chloride were incubated with a cell-free extract of Proteus vulgaris for 90 min. Control experiments were carried out without the addition of enzyme extract. In the experiments in which the amide was incubated with isotopic ammonia without enzymes, the apparent isotope concentration of the amide group was below that of the ammonia of the last distillate before liberation of the amide group. However, in the presence of enzymes a considerable exchange took place. Up to 8% of the amide group of glutamine was exchanged. The rapid exchange of the amide groups of asparagine and glutamine with ammonia supports the view that amides, once formed, probably by mediation of energy-rich acyl phosphate, may take part in further synthetic reactions by transfer of the glutamyl or aspartyl radical.

4795 Growth. Paul C. Zamecnik and Joseph C. Aub. Ann. Rev. Physiol. 12, 71-100(1950).

The authors summarize that portion of the field which bears on protein metabolism and which was published in the

journals from January 1948 to July 1949. Mention is made of the use of radioisotope technique and ion exchange resins for studies of incorporation of amino acids into proteins and of interconversions of amino acids, the use of C^{14} and N^{15} in the study of peptide and protein synthesis, the uptake of C^{14} from bicarbonate by tissue cultures of chick embryo muscle, the effect of growth hormones (using S^{35}) on protein metabolism, and of the use of C^{14} and S^{35} as tracers in the study of malignant cells. 192 references.

4796 Intermediary Metabolism of Phosphorus Compounds. Fritz Lipmann and Nathan O. Kaplan. Ann. Rev. Biochem. 18, 267-98(1949).

The authors present a review of the literature in the field including the work done from December 1946 to December 1948. A short report is made on the study of phosphate turnover in living organisms in the presence of light by the use of radioactive phosphorus. Reference is made also to the use of C^{14} in the study of the products of photosynthesis. 199 references.

4797 Metabolism of C^{13}-Carboxyl-labeled Malonate by the Intact Mouse. Nathan Lifson and Joyce A. Stolen. Proc. Soc. Exptl. Biol. Med. 74, 451-3(1950) June.

When C^{13}-carboxyl-labeled malonate was injected subcutaneously into mice, 20 to 32% of the labeled carbon was recovered in the respiratory carbon dioxide in 6 hr. At body temperature, dog plasma showed little or no ability to decarboxylate malonate. These results are interpreted to indicate the probable occurrence in mammalian cells of enzymatic mechanisms for conversion of malonate to carbon dioxide. 11 references. (auth)

4798 Metabolism of the Lipids. A. L. Lehninger. Ann. Rev. Biochem. 18, 191-216(1949).

The author presents the contributions to the field from November 1947 to November 1948 obtained by a thorough literature search. Several experiments in which P^{32} and C^{14} were used to label compounds are mentioned. In addition reference is made to a comprehensive review of the use of isotopes in biology and medicine by K. Bloch (Univ. of Wis. Press, 243-59(1948)). 190 references.

4799 Metabolism of Proteins and Amino Acids. A. Neuberger. Ann. Rev. Biochem. 18, 243-66(1949).

This article is a review of selected topics in the field covering the period from November 1, 1947, to November 1, 1948. The study of the metabolism of glycine, lysine, and tyrosine by using C^{13} and C^{14} is included. 164 references.

4800 The Metabolism of Radioactive Dibromoestrone in Man. Gray H. Twombly and Erwin F. Schoenewaldt. Cancer 3, 601-7(1950) July.

Dibromoestrone labeled with radioactive Br^{82} was injected into 11 patients. In 8 of these, a drainage tube was present in the common bile duct so that complete collections of bile as well as urine were possible. Four of these 8 were studied on two different occasions. The other 3 patients were injected with the steroid 12 hr before operation. The subsequent operations were a radical mastectomy for cancer of the breast, a radical hysterectomy for cancer of the cervix, and a total hysterectomy for fibromyomata uteri. The principal route

of excretion for dibromoestrone was found to be via the bile. Thirty-nine per cent of the radioactivity was found in this fluid in 24 hr and only 18% in the urine. Patients showing the least evidence of liver damage showed the highest excretion rates, 5 patients averaging 53% in 24 hr. The peak of excretion occurred in these patients 1 to 2 hr after injection. The peak of excretion in those showing evidence of liver damage occurred later, 3 to 4 hr, and were lower. As the patient returned toward normal, the biliary excretion rate increased. There was no evidence of selective localization of dibromoestrone in the breast or uterus or any parts of these organs or in the cancerous tissue. Dibromoestrone seems to be excreted in the bile as an easily hydrolyzed ether. There is no marked degradation of the compound in its passage through the body. (auth)

4801 Mineral Metabolism (Fluorine and Other Trace Elements). F. J. McClure. Ann. Rev. Biochem. 18, 335-54(1949).

An over-all review of the field covering the period from January 1943 to September 1948 is made by the author. Experiments on the metabolism of cobalt using a tracer indicate that cobalt is retained only to a very small degree when administered orally or by injection, the liver being the most important depository. 197 references.

4802 Nucleoproteins, Nucleic Acids, and Derived Substances. J. N. Davidson. Ann. Rev. Biochem. 18, 155-90(1949).

This article is an extensive review covering the period from November 1947 to October 1948. The use of P^{32} and N^{15} as tracers is mentioned. The effect of x- and γ radiation in blocking a normal process of conversion to cytoplasmic pentose nucleotides to nuclear DNA (desoxyribonucleic acid) is discussed. 284 references.

4803 The Peripheral Circulation. O. G. Edholm. Ann. Rev. Physiol. 12, 311-44(1950).

This is a partial review of the literature in the field from July 1948 to June 1949. References are given to other recent reviews of a more restricted nature. The author mentions the use of radioactive sodium as a tracer to determine blood circulation time, P^{32} tagged cells to estimate blood volume, and the effect of x-radiation on arterial pressure. 315 references.

4804 Physical Properties of Protoplasm. M. J. Kopac. Ann. Rev. Physiol. 12, 7-26(1950).

The author gives a brief review of most of the important papers in the field from September 1947 to July 1949. The damage of egg chromosomes and cytoplasm by x-radiation is reported as well as the uptake and exchange of various radioactive isotopes (P^{32}, Na^{24}) in egg and nerve cells of different organisms. 142 references.

4805 The Physiology of Supporting Tissue. M. J. Dallemagne. Ann. Rev. Physiol. 12, 101-18(1950).

The author reviews the recent contributions to the field and discusses the use of radioisotopes (P, Ca, Sr, Y, Ce, U, C) in the study of bone metabolism. 242 references.

4806 Radioactive Isotopes. Logan A. Spann. Proc. Staff Meeting Hillcrest Memorial Hosp. 8, 177-82(1950) Mar.

A general discussion is presented on the nature and use of radioactive isotopes. The unit for radioactive isotopes, the dose of radiation delivered by the isotopes, safety and protection measures, and the use of the radioactive isotopes as tracers and in therapy are some of the topics discussed under separate headings. Radioiodine therapy is described in some detail, and mention is made of the application of such isotopes as C^{14}, N^{15}, F^{18}, Na^{24}, P^{32}, S^{35}, Ca^{45}, As^{74}, Hg^{197}, Au^{198}, and Pb^{210}.

4807 Selective Absorption of Sulfur-35 by Fungus-Infected Leaves. C. E. Yarwood and Louis Jacobson. Nature 165, 973-4(1950) June 17 (Letter to the editor).

Rust and mildew infected plant leaves were exposed to vapor from sodium sulfide containing S^{35}. Radioautographs showed localization of sulfur by the infected areas. The treatment was lethal to the fungus but did not injure the host, demonstrating that sulfur in therapeutic amounts is selectively absorbed by diseased leaf tissue (host + pathogen).

4808 Studies of the D-Glutamic Acid Metabolism of Tumors. I. Increase in D_2O Content of the Body Fluids in Tumorous Rats. F. Kögl, A. J. Klein, H. Erxleben, and G. J. Van Veersen. Rec. trav. chim. 69, 822-33(1950) June (in German).

Tumorous rats were given drinking water with increased D_2O content. They were sacrificed at intervals and the degree of deuterium incorporation was determined. The D-form of glutamic acid in the tumor protein lagged far behind the L-form in deuterium content at first (7 to 12 days), but over a longer period (17 days) reached the same content value as that of the L-form present in tumor protein and normal liver protein.

4809 Studies of the D-Glutamic Acid Metabolism of Tumors. II. Feeding Experiments with Deuterio-DL-Glutamate. F. Kögl, H. Erxleben, A. J. Klein, and G. J. Van Veersen. Rec. trav. chim. 69, 834-40 (1950) June (in German).

Tumorous rats were fed DL-glutimate, by mouth, over 5- and 15-day periods. L-glutamic acid, then isolated from the tumor protein, showed practically no deuterium content while the D-form showed an amount about ten times the probable error. Apparently, the simplest import of the result is that D-glutamic acid in food is, to a small degree, incorporated directly into tumor protein.

4810 Studies of the D-Glutamic Acid Metabolism of Tumors. III. Injections with DL-, L-, and D-forms of Deuterioglutamate. F. Kögl, H. Erxleben, A. J. Klein, and G. J. Van Veersen. Rec. trav. chim. 69, 841-50(1950) June (in German).

Tumorous rats were injected subcutaneously, over a period of four days, with deuterium-labeled DL-glutamic acid in the form of aqueous solutions of mono-sodium salts. The deuterium content of D-glutamic acid, subsequently isolated from tumor protein, was substantially greater than that of the L-form. When the two labeled forms were injected separately the D-form, after isolation, again showed substantial deuterium content while the L-form was practically deuterium-free.

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4811 Synthesis of Cholesterol and Fatty Acids in Foetuses and in Mammary Glands of Pregnant Rabbits. G. Popjak and Marie-Louise Beeckmans. Biochem. J. 46, 547-58(1950) May.

The synthesis of cholesterol and fatty acids in the rabbit fetus has been demonstrated by the rapid incorporation of deuterium from the body water into these substances and by the utilization of C^{14}-labeled acetate for these syntheses. It is concluded (a) that all fetal cholesterol is obtained by synthesis within the body of the fetus; (b) that while the fetal extrahepatic tissues synthesize cholesterol, they do not degrade it; and (c) that the fetal liver synthesizes as well as degrades cholesterol, but the amount degraded is only one-half of the amount synthesized on the 28th day of pregnancy. Synthesis of both saturated and unsaturated fatty acids in the fetal liver and extrahepatic tissues (embryonal adipose tissue) has been demonstrated. The fatty acids in the fetal liver contained much less deuterium than those in the extrahepatic tissues; this difference might be due to dilution of fatty acids in the fetal liver by maternal substances. However, when C^{14}-labeled acetate was given, the fatty acids in the fetal liver contained more C^{14} than in the fetal carcass. The discrepancy in the results obtained with deuterium and C^{14} suggests that the fat precursors in the fetal liver and extrahepatic tissues are not identical. The fetal placenta synthesizes all lipids studied, but it also absorbs these from the maternal circulation. The maternal placenta appears metabolically inert, at least toward the end of pregnancy. A method, based on principles developed by Goldwater and Stetten (J. Biol. Chem. 169, 723(1947)) is presented for the calculation, in isotope experiments, of the rate of accumulation, synthesis, and degradation of a substance in a growing system. Since there was no apparent destruction of fat in the fetus, it is inferred that the primary source of energy in the fetus must be carbohydrate and that growth is characterized not so much by increased rate of synthesis as by reduced rate or absence of degradation. The synthesis of cholesterol and fatty acids in the nonlactating mammae of pregnant rabbits has been shown. Evidence for the specific utilization of acetate for the formation of C_4-C_8 acids in the mammae is also presented. 22 references. (auth)

4812 Tumor-Host Studies. II. Increased Concentration of Tagged Iodotyrosines in the Gastrointestinal Tract of Rats Bearing Tumors. Kenneth G. Scott, and Robert S. Stone. Cancer 3, 722-4(1950) July.

Mono- and diiodotyrosine tagged with I^{131} have been used in these studies in order to compare their behavior in the gastrointestinal tract of normal and of tumor-bearing animals. It has been found that the presence of tumors in rats results in profound changes in the metabolism of these compounds. The per cent of the dose of iodotyrosine in the gastrointestinal contents increases in direct proportion to the size of the tumor. The manner by which the tumor induces this aberrant behavior of the gastrointestinal tract of the host is not known. When filtered homogenates of tumor tissue plus normal saline were administered subcutaneously to normal rats, the diiodotyrosine content of the gastrointestinal tract was as much as 470% greater than normal, 24 hr after the administration of both the tumor homogenate and the tagged diiodotyrosine. These results suggest that the agent responsible for this is a chemical entity present in the tumor.

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4813 The Uptake of Radioactive Phosphate by the Excised Gill of the Mussel, Mytilus Edulis. R. R. Ronkin. J. Cellular Comp. Physiol. 35, 241-60(1950) Apr.

A glass chamber was devised in which excised fragments of the ctenidia of Mytilus edulis L., a pelecypod mollusk, could be irrigated with an artificial sea water containing radioactive phosphorus (P^{32}) as phosphate. By placing the ionization tube of a Geiger-Mueller counter over the chamber, continuous estimates of the rate of phosphate uptake of the tissue were obtained. Assuming a simple logarithmic course of uptake to predominate for the first several hours, the half-time for this process was 140 min at 15°C, with an external phosphate concentration of 5 μmoles per liter. Chemical and radioactive assay revealed that only 0.06% of the intracellular phosphate was exchanged after the tissue had been immersed for 140 min. When the outside phosphate concentration was raised the radioactivity of the tissue rose faster, but much faster at the highest concentration (500 μmoles per liter) than might have been expected on the basis of a linear relationship between concentration and rate of entry. The general problems of phosphate penetration and metabolism are considered in relation to these findings. The possible role of phosphate in the mollusk gill is discussed. 23 references. (auth)

4814 Water Metabolism. J. Russell Elkinton. Ann. Rev. Physiol. 12, 145-178(1950).

This article is a digest of the work done in the field from July 1947 to June 1949. Those investigations in which exchanges of the principle ionic solutes pertain to the exchanges of the solvent, water, between the several phases of body fluids, and between the body as a whole and the environment, are reviewed. The study of the active transport of intracellular sodium using Na^{24} and the use of Na^{24} and Cl^{36} to calculate extracellular fluids in dogs are discussed. 199 references.

4815 Water Soluble Vitamins. E. L. R. Stokstad and T. H. Jukes. Ann. Rev. Biochem. 18, 435-86(1949).

This article is a general review of the field from December 1947 to December 1948. The use of C^{13} in the carboxyl group of dietary nicotinic acid fed to rats is mentioned briefly. 360 references.

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4816 The Solubility of Hydrogen, Oxygen, Nitrogen, and Helium in Water at Elevated Temperatures. H. A. Pray, C. E. Schweickert, and B. H. Minnich. BMI-T-25, May 15, 1950. 29p.

The increasing application of high temperatures and pressures to various processes has made a knowledge of the solubilities of compressed gases in water necessary for purposes of engineering design. The solubilities of oxygen, hydrogen, helium, and nitrogen were determined volumetrically in water at temperatures from 125° to 650°F at pressures up to approximately 500 psi absolute. The apparatus used is described and its operation outlined. Extensive tables and graphs of the data are included.

4817 The Kinetics of Isotopic Exchange Reactions. T. H. Norris. J. Phys. & Colloid Chem. 54, 777-83(1950) June.

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An isotopic exchange reaction must proceed toward equilibrium according to a first-order rate law or according to concurrent first-order laws. A discussion is given of the implications of this concept for the experimental study of the kinetics of exchange reactions. Expressions are tabulated for the fraction of exchange equilibrium attained at any time in terms of quantities which are experimentally determinable. 15 references. (auth)

4818 Study of a Titrimetric Micro-Determination of Carbonate. A. F. Stehney and D. N. Hume. AECD-2868, May 25, 1950, Decl. June 14, 1950. 33p.

A convenient method for the determination of carbonate on a microscale has been developed. The method is based on the diffusion procedure described by Conway (Micro-Diffusion Analysis and Volumetric Error, New York, D. Van Nostrand, 1940). The sample is acidified and the carbon dioxide which is evolved is adsorbed in a known amount of barium hydroxide solution; the excess barium hydroxide is then titrated with acid using a microburet. Less than one-third of a micromole of carbonate ion can be determined with an error of less than 5%. The possible errors due to exchange of carbon dioxide between the atmosphere and microvolumes of carbonate or bicarbonate solutions were studied and found to be of minor importance in the analytical procedure recommended. 11 references. (auth)

4819 The Polarographic Determination of Small Amounts of Chromium in Calcium. Doris V. Stage and Charles V. Banks. AECU-845, nd. 8p.

A polarographic method for the determination of small amounts of chromium in calcium metal is proposed. The diffusion current of the first chromium wave, occurring at −1.0 volt vs the saturated calomel electrode in 1M calcium chloride, was found to be directly proportional to the concentration. Factors affecting the diffusion current are discussed, and optimum conditions for the determination are described. (auth)

4820 Spectrophotometric Determination of Beryllium in Aluminum by Means of the Sulfosalicylate Complex. H. V. Meek and Charles V. Banks. AECU-846, nd. 24p.

A method of determining small amounts of beryllium in aluminum is described. This method depends upon the fact that the beryllium-sulfosalicylate complex has an absorption maximum at a longer wavelength than does the sulfosalicylate alone. The optimum wavelength is 317.0 mμ. The procedure is designed to accommodate the range of 0.0015 to 0.23% beryllium in aluminum but may be conveniently changed to accommodate much higher or lower ranges. Interference by the aluminum-sulfosalicylate complex is eliminated by complexing the bulk of the aluminum with N, N, N′, N′-tetrakis-(carboxymethyl)-ethylenediamine and by adding approximately the same amount of aluminum to the standards as is present in the samples. Copper and iron, particularly the latter, must not be present in more than trace amounts. The interference by iron is effectively eliminated by extraction with β, β′-dichloroethyl ether. (auth)

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4821 Identity and Instability of the Beryllium-Sulfosalicylate Complex. H. V. Meek and Charles V. Banks. AECU-847, nd. 37p.

The spectrophotometric properties of the beryllium-sulfosalicylate complex are described. It has been shown that sulfosalicylic acid from commercial sources is either 5-sulfosalicylic acid, or, at least for the purpose of complex formation with beryllium, the behavior is the same as that of 5-sulfosalicylic acid. The method of continuous variations, developed by Job (Ann. chim., 9, 113(1928)) has been used to show that the mole ratio of sulfosalicylate to beryllium in the complex is 2:1. By the constancy of the maximum composition at various wavelengths it has been shown that only the one complex is present in appreciable quantities at the optimum pH. An alkalimetric titration of pure beryllium basic acetate, $Be_4O(C_2H_3O_2)_6$, in solutions containing a large excess of sulfosalicylate, was employed to show that at the optimum pH of complex formation, both of the hydroxylic hydrogen atoms of the sulfosalicylate ions are removed in the formation of the complex. The formula for the complex ion is therefore best represented as $Be(C_6H_3SO_3OCO_2)_2^{-4}$ Qualitative theoretical justification for this formulation is presented. The equilibrium constant for the dissociation of the complex ion, $Be(C_6H_3SO_3OCO_2)_2^{-4}$ into simple sulfosalicylate ions, $C_6H_3SO_3OHCO_2^{-2}$, and an unknown beryllium species, Be_x, at the optimum pH has been shown to be equal to approximately 2.1×10^{-9} at 25 ± 1°. 10 references. (auth)

4822 Measurement of Radiocarbon as Carbon Dioxide Inside Geiger-Mueller Counters. Maxwell Leigh Eidinoff. Anal. Chem. 22, 529-34(1950) Apr. (See also NSA 2-202.)

The measurement of radiocarbon activity as carbon dioxide admixed with carbon disulfide vapor has been studied as a quantitative procedure over the pressure range 2-175 cm of mercury. The counting rate was found to be directly proportional to the quantity of active gas sample. In the region 1 to 4 cm of carbon dioxide pressure the average deviation from the straight line drawn through the origin for 11 measurements was less than 1.2%. At a total pressure of about 50 cm the average deviation of seven measurements from the straight line drawn for counting rate versus moles of standard active sample was 0.4%. Plateau lengths over 200 v with slopes usually less than 2%/100 v are obtained over the threshold counting range of 1500 to about 8000 v. The gas trains and apparatus for conversion of barium carbonate to carbon dioxide showed negligible memory effects and permitted precise measurement of the quantity of carbon dioxide inside the counter tube. The construction of Geiger-Mueller counter tubes and auxiliary equipment is described. (auth)

4823 A Rapid and Accurate Method of Measuring Line Intensities in Spectrochemical Analysis. N. W. H. Addink. Spectrochim. Acta 4, No. 1, 36-42(1950).

A method of measuring line intensities in spectrochemical analysis is developed, based on the principle of visual comparison with standard density lines (standard paper density scale). The method gives results as accurate as those obtained by means of the densitometer (5%); it includes a correction for background intensity and it speeds up the quanti-

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tative analysis, as the qualitative inspection of the spectrum and the measurement of line intensities can be made simultaneously. The use of a densitometer is eliminated by this method. Examples of analytical results and of the time necessary for quantitative analysis according to this method are given. (auth)

4824 Atomic Weights as a Function of a Sequence of Whole Numbers. I. R. Morozov. Zhurnal Obschcheĭ Khim. 20, 555-6(1950)(in Russian).

Atomic weights of all elements with the exception of H and He, are given, with a good and uniform approximation, by the formula $W = (2 + N)^{1.2}$, where N is the atomic number. Vincent's formula $W = N^{1.21}$, which was known to Mendeleev, is satisfactory only for heavy elements.

4825 Work Functions of the Elements. Herbert B. Michaelson. J. Applied Phys. 21, 536-40(1950) June.

Like the chemical properties of the elements, the work function ϕ is a periodic function of atomic number, as shown clearly by a new compilation of published data for 57 elements. The progressive rise and fall of work function values throughout the table of the elements appears to be sufficiently regular to permit approximations to be made of values for the metallic and semimetallic elements on which no data have yet been published. Since the first ionization potential E_i and electrode potential E^0 exhibit a similar periodic function of atomic number, a striking resemblance exists among the respective plots of ϕ, E_i, and E^0. (auth)

4826 Electron Deficient Compounds. V: The Structure of Dimethylberyllium. R. E. Rundle and A. I. Snow. AECU-844, nd. 3p.

Dimethylberyllium, a compound subliming at 200°C, involves 4 tetrahedral, electron deficient bonds to beryllium. The compound is body centered, orthorhombic, and isomorphous with SiS_2.

4827 Heavy Water. Frank T. Barr. AECD-2871, Nov. 23, 1949, Decl. Jan. 20, 1950. 38p.

This report consists of a lecture which discusses the properties of D_2O, methods of preparation of D_2O, its manufacture, and its uses.

4828 Possible Distillation or Similar Methods for the Recovery of D_2O. D. C. Stedman. National Research Laboratories (Canada) Report No. C50-49S, June 8, 1949. 19p.

The processes suggested for further consideration are: (a) distillation of H_2. (b) exchange recovery from existing supplies of H_2 by cascade "scrubbing" with water in the gas phase in the presence of an exchange catalyst; (c) examination of the possibilities of liquid phase water scrubbing in process "b" above; (d) distillation of synthetic NH_3; (e) carbon adsorption from H_2O. Of these, the distillation of NH_3 is the most straightforward, and after suitable initial tests a plant could be designed readily. Direct distillation of H_2 is certain to offer many technical difficulties but would probably be the cheapest in the long run. The other methods are not considered in detail because of lack of adequate data.

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4829 Ultra-Violet Band-Systems of CF. E. B. Andrews and R. F. Barrow. Nature 165, 890(1950) June 3.

The band-spectrum of CF has been obtained by an electrodeless discharge through a stream of fluorocarbon vapor using an oscillator of about 30 m wavelength. A vibrational and rotational analysis of the band system in the ultraviolet region was made.

4830 Evidence from the Raman Effect for Presence of Germanium Chlorobromoform in the Equilibrium Reaction of Germanium Chloroform and Germanium Bromoform. Marie-Louise Delwaulle. Compt. rend. 230, 1945-6(1950) May 31 (in French).

Raman spectrum structure no attributable to $GeHCl_3$ or $GeHBr_3$, in a mixture of the two, is presented as evidence of the intermediate compositions $GeHCl_2Br$ and $GeHClBr_2$ because of the similarity of the pattern to that of the series $CHCl_3$, $CHCl_2Br$, $CHClBr_2$, and $CHBr_3$.

4831 Elementary Processes in Radiation Chemistry. I. Some Considerations of Mechanism of Electron Capture. John L. Magee and Milton Burton. J. Am. Chem. Soc. 72, 1965-74(1950) May.

Assuming that the capture of an electron by a molecule is an adiabatic process, a general discussion and method of attack for the problem is given. Necessary potential energy curves are given for application of the method to hydrogen systems, and a contour surface is calculated for the isosceles H_3^+ system (plus an electron) and the intersections of that surface with the isosceles $H_2(^3\Sigma) + H$ and $H_2(^1\Sigma) + H$ surfaces calculated to a required degree of approximation. It is shown that the probability of nonradiative capture of an electron by a positive ion exceeds that of radiative capture by a factor of 10^6 and that the capture of an electron by a normal H_3 leads with maximum probability to one normal and one excited H atom. Capture of an electron by normal H_3^+ considerably favors transition to the $H_2(^1\Sigma) + H$ state rather than to the $H_2(^3\Sigma) + H$ state because of a sensible activation energy difference between the two processes. It is shown that transitions of the class leading to the $H_2^* + H$ system are important for complicated molecule systems and that the favored transition leads to immediate dissociation into three H atoms. Capture of an electron by an isolated complicated molecule ion appears to lead in most cases to immediate dissociation into two particles, one of which is excited. Dissociation into radicals is favored over dissociation into molecules; in the liquid state the ultimate molecule mechanism increases in relative importance.

4832 Fluctuations in Density of Liquids Under the Action of the β and γ Rays of Radium. Georges Antonoff and Alexis Yakimac. Compt. rend. 230, 1952-3 (1950) May 31 (in French).

Isoamyl alcohol was subjected to the radiations from radium contained in an immersed glass tube of 0.027-mm wall thickness. The density was found to decrease for about 15 days and then to return toward its original value during the next 15. The magnitude of the effect was greatly increased by moving the radium to 1.5 m from the liquid and covering it with 5 cm of lead.

4833 Radiation Chemistry of Ferrous-Ferric Systems. C. B. Amphlett. Nature 165, 977-8(1950) June 17 (Letter to the editor).

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Preliminary experiments are reported in which a study was made of the effects of radium γ rays and 200-kev x-rays on ferrous and ferric solutions. These were tried as perchlorates in perchloric acid of varying pH, where the only complex likely to be formed was FeO H^{2+}, and also in the presence of agents forming complexes, such as chlorides, fluorides, thiocyanates and various organic reagents. It was found possible to obtain 100% oxidation of some ferrous systems and 100% reduction of suitable ferric systems. Emphasis is placed on the possibility of complex formation in accounting for many of the results.

4834 On the Isotope Shift in the Spectrum of Cerium. Peter Brix and Helmut Frank. Z. Physik 127, 289-96(1950) Jan. (in German).

Ce II transitions ($4f^2 6s - 4f^2 6p$) between 4450 and 4750 A exhibit an isotope shift. The frequency of the transition for Ce^{142} is shifted toward the red compared to that for Ce^{140}, the magnitude of the shift being, on the average, 54×10^{-3} cm^{-1}. The magnitude of the isotope effect increases by a factor of 2 between barium and cerium. This sudden increase appears to be connected with the magic neutron number 82, cerium being the only element whose stable isotopes span this number.

4835 On the Vibration Spectra and Electronic Absorption Spectra of a Rare Earth Salt. J. P. Mathieu. Ann. Phys. 5, 379-83(1950) May-June (in French).

The double nitrates with the general formula $(NO_3)_{12}M_2M'_3 \cdot 24H_2O$, where M is a rare earth metal and M' a bivalent metal (Mg,Zn,Co----), are all isomorphs. Some are readily obtained as fine crystals, as in the case of $(NO_3)_{12}Nd_2Zn_3 \cdot 24H_2O$. The Raman spectrum gives information as to the structure of this compound in accord with its electronic absorption spectrum in the visible region. (auth)

4836 Studies of Recovery Processes for Western Uranium Bearing Ores. VI. Precipitation of Vanadium Red Cake. F. G. Seeley and C. F. Coleman. AECD-2867, Oct. 20, 1949, Decl. June 29, 1950. 35p.

An empirical study has been made of the precipitation of vanadium red cake, a sodium polyvanadate of unknown constitution, from carbonate leach liquors. Best precipitation was obtained at pH 2.0 to 2.5. The rate of precipitation was increased by increase of the initial vanadium concentration, or of the sodium chloride or sulfate concentration. Phosphate interfered with the precipitations.

4837 The Adsorption Separation of Zirconium and Hafnium. Robert S. Hansen, Keith Gunnar, Alfred Jacobs, and C. Robert Simmons. AECU-842, nd. 13p.

An adsorption purification of zirconium from hafnium has been discovered. Most satisfactory results have been obtained from the preferential adsorption of hafnium by silica gel from a methanol solution of zirconium and hafnium tetrachlorides. Other solvents have been investigated, as well as effects of concentration, flow rate, and gel properties. Concentration of adsorbed hafnium to 30 to 60% products in good yields has been achieved by differential stripping. 11 references. (auth)

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4838 The Separation and Mounting of Some Fission Elements by Electrodeposition. D. Lee and G. B. Cook. Atomic Energy Research Establishment Report No. AERE-C/R-430, Oct. 1949. 21p.

A method is described for the separation of silver, rhodium, tin, antimony, tellurium, and cadmium from fission product mixtures, and also a technique for mounting these elements uniformly by electrodeposition on a very thin metal film supported on 0.001-in. thick plastic sheet. Several determinations of the fission yields of these elements using the value of 0.018% for Ag^{111} as a standard, have been made. (auth)

4839 The Production of P^{32} From Pile-Irradiated Sulphur. A. W. Kenny and W. J. Spragg. Atomic Energy Research Establishment Report No. AERE-C/R-485, Jan. 1950. 29p.

Conditions are defined for minimizing the losses of P^{32} at the various stages in the Cohn method of extracting P^{32} from sulfur (MDDC-518). Under these conditions the loss is not greater than 1% at any stage, except in the preliminary sulfur treatment and in the final purification by passing through a cation-exchange column, when serious losses may occur if appreciable amounts of impurity, particularly aluminum or chromium, are present. An alternative to the final stage, namely, precipitation on dialyzed iron has been developed; the loss need not be greater than 1% in this alternative stage. 15 references. (auth)

4840 Lamps and Wavelengths of Mercury 198. William F. Meggers and F. Oliver Westfall. J. Research Natl. Bur. Standards 44, 447-55(1950) May.

The production and extraction of artificial Hg^{198} from Au^{197} bombarded by neutrons is described, and the procedure in making electrodeless lamps with Hg^{198} is given in detail. When these lamps are excited by high-frequency radio waves, they emit the mercury spectrum entirely free from isotope shifts and hyperfine structures that characterize natural mercury. Fabry-Perot interferometers and a prism spectrograph were employed for measuring, relative to Cd 6438.4696 A, the wavelengths of the stronger lines in the visible spectrum of Hg^{198}. Preliminary values for Hg^{198} radiations in normal air are reported as 5790.6627, 5769.5984, 5460.7532, 4358.3377, 4077.8383, and 4046.5717 A, with probable errors not exceeding ±0.0001 A. (auth)

4841 Singlet System B of ZrO. M. Afaf. Proc. Phys. Soc. (London) 63, 674-5(1950) June 1. (Letter to the editor)

The identity of a new singlet system for ZrO, of which the λ 5185 band head is the (0,0) band, has been established. In all, only 9 band heads were observed for system B, as it is designated to distinguish it from system A in the ultraviolet with the (0,0) band head at λ 3682. A possible intercombination system will lie in the infrared near 13,000 A.

4842 The Synthesis of Codeine Labeled in the 3-Methoxy Group with C^{14}. F. N. H. Chang, J. F. Oneto, Peter P. T. Sah, B. M. Tolbert, and H. Rapoport. J. Org. Chem. 15, 634-6(1950) May.

Codeine labeled in the 3-methoxy position with C^{14} has been prepared on a 20-mole scale in a yield of 63% based on methyl-C^{14} iodide. Morphine was first converted to the monosodium derivative and then allowed to react with chloro-

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methyl ether. The syrupy methoxymethyl ether of morphine thus obtained was oxidized with 30% hydrogen peroxide and the product, the methoxymethyl ether of morphine-N-oxide, was obtained after hydrolysis with dilute sulfuric acid and subsequent alkalinization with ammonia. With this pure morphine-N-oxide as the starting material, methylation was carried out successfully with methyl-C^{14} iodide. The codeine-N-oxide thus obtained was immediately reduced by sulfur dioxide to codeine. After purification, the free base was converted to both codeine-C^{14} sulfate and codeine-C^{14} hydrochloride. These salts possess properties identical with the U.S.P. products described in the literature.

4843 Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. 134p.

The following papers were presented: A Preliminary Report on the Mechanism of the Decomposition of Diacetyl Peroxide in Acetic Acid, by A. J. Fry, B. M. Tolbert, and M. Calvin; The Preparation of Demerol-N-Methyl-C^{14} by Reductive Methylation, by W. Tarpey, H. Hauptmann, B. M. Tolbert, and H. Rapoport; The Use of Carbon-14 in a Study of the Mechanism of the Heterogeneous Oxidation of Acetylene over Silver Nitrate, by W. T. M. Johnson and K. A. Krieger; Isotope Effects in the Decarboxylation of Dibasic Acids, by A. A. Bothner-By, L. Friedman, and J. Bigeleisen; C^{14} Tracer Studies in the Rearrangements of α-Diketones. III. The Rearrangement of Unsymmetrical Benzils, by O. K. Neville; Mechanism of the Faworskii Reaction, by R. B. Loftfield; Primary Processes Involving Radiobromine at the Carbon-Carbon Double Bond, by R. R. Williams, Jr., W. H. Hamill, and H. A. Schwarz; Detection and Identification of Free Radicals by the use of Radiohalogens, by W. H. Hamill, R. R. Williams, Jr., and E. E. Voiland; Rearrangements of Carbon Atoms in t-Butyl and t-Amyl Derivatives, by J. D. Roberts, R. E. McMahon, and J. S. Hine; Catalytic Hydrogenolysis, by E. R. Alexander, A. G. Pinkus, and F. W. Stone; On the Mechanism of the Chemical Formation of Lactic Acid from Glucose Studied with C^{14} Glucose, by M. Gibbs.

Attached is the following report containing the results of a discussion group which met on January 18, 1950: The Nomenclature of Organic Molecules Containing Isotopic Atoms, by R. C. Anderson.

4844 A Preliminary Report on the Mechanism of the Decomposition of Diacetyl Peroxide in Acetic Acid. A. J. Fry, B. M. Tolbert, and M. Calvin. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p1-9.

The decomposition of diacetyl peroxide in aliphatic acids has been reported to result in the formation of succinic acid or its substitution derivatives, methane, carbon dioxide, and some methyl acetate. The decomposition of diacetyl peroixde in acetic acid-2-C^{14} has been studied. The activity of the products in general confirmed the mechanism of the reaction as proposed by Kharasch and Gladstone (J. Am. Chem. Soc. 65, 15(1943)). The presence and distribution of activity in the methyl acetate produced in this reaction is not explained by the previously proposed mechanism. There was no appreciable exchange of acetic acid and diacetyl peroxide under the conditions of the reaction. Essentially no exchange of methyl acetate and acetic acid was observed when these reagents were heated at 100° for 5 hr.

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4845 The Preparation of Demerol-N-Methyl-C^{14} by Reductive Methylation. Winifred Tarpey, H. Hauptmann, B. M. Tolbert, and H. Rapoport. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p10-15.

Demerol, the hydrochloride salt of N-methyl-4-phenyl-4-carbethoxypiperidien, has been synthesized, labeled with C^{14} in the N-methyl group, by use of the formate-formaldehyde reductive methylation method (Clarke et al, J. Am. Chem. Soc. 55, 4571(1933); Staple and Wagner, J. Org. Chem. 14, 559(1949)). By the use of labeled formaldehyde in one reaction and labeled formic acid in another, it has been shown that in this reaction the formaldehyde is the source of the N-methyl group, that the only major source of the reductive action is formic acid going to carbon dioxide, and that there is no exchange between the formic acid and formaldehyde.

4846 The Use of Carbon-14 in a Study of the Mechanism of the Heterogeneous Oxidation of Acetylene over Silver Nitrate. W. T. M. Johnson and K. A. Kreiger. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p16-38.

The accumulation of acetylene in the reboilers of air liquefaction apparatus constitutes a considerable explosion hazard, and the removal of acetylene in traces from the air stream to such plants, is, therefore, a problem of economic importance. The results of prebous work (K. A. Krieger, J. Am. Chem. Soc. 71, 3156(1949)) on the catalytic behavior of silver nitrate, supported on high area activated alumina F-10 and on low-area tabular alumina T-72, on the oxidation mechanism of trace amounts of acetylene gas in air are briefly reviewed. Since the previous work was incomplete, an intensive investigation was undertaken with catalyst 192 (9.67% silver), using C^{14}-labeled acetylene as a tracer and an apparatus designed to detect CO_2 and CO as well as acetylene in the products at very low concentrations. The results support the hypothesis that acetylene removal is due to two distinct processes, adsorption and oxidation. Reaction mechanisms are postulated, but the experimental results are too incomplete for confirmation.

4847 Isotope Effects in the Decarboxylation of Dibasic Acids. A. A. Bothner-By, L. Friedman, and J. Bigeleisen. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p39-48.

The hypothesis of a carbon-carbon bond rupture as the reaction rate determining step in the decarboxylation of malonic acid is considered. This hypothesis infers an isotope effect upon C^{13}-substitution for C^{12} at any position in malonic acid. To investigate this hypothesis, the isotopic fractionation in the decarboxylation of malonic acid was measured. Close agreement between theory and experiment was found, thus supporting the hypothesis.

In the pyrolysis of barium adipate, decarboxylation is coupled with simultaneous cyclization to produce cyclopentane. In order to investigate the reaction mechanisms, the isotopic composition of the products of pyrolysis of barium adipate was determined and compared with the isotopic composition of the substrate. The results indicate that the symmetry of the barium adipate is destroyed without any changes occurring in either of the carboxyl carbons. How-

ever, either of two mechanisms is possible, and further experiments are necessary for conclusive results.

4848 C^{14} Tracer Studies in the Rearrangements of α-Diketones. III. The Rearrangement of Unsymmetrical Benzils. O. K. Neville. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p49-58.

This paper reports the progress made in these studies and discusses the direction of present and future research not yet completed. The transformation of α-diketones, orthoquinones, or α-ketoaldehydes to salts of glycolic acids in the presence of aqueous or fused alkali is recognized as a fairly general organic reaction:

$$RCOCOR' + NaOH \longrightarrow R\text{-}\overset{R'}{\underset{|}{C}}OHCOOH.$$

The reaction involves the addition of a mole of alkali and the shift of one of the R- groups to the adjacent carbon atom. Just which of two dissimilar R- groups migrates cannot be discovered from the identification of the product, since the same glycolic acid is formed regardless of the path of the reaction. By labeling one of the carbonyl groups with isotopic carbon, it is possible to identify the migrating group from the position of the labeled atom in the acid product. With C^{14} as the tracer atom, four suitably labeled compounds in all, of which one R- group was phenyl, have been prepared and subjected to the conditions of the rearrangement. In each case, the glycolic acid was purified and degraded by chromic acid oxidation to carbon dioxide and the acid or ketone containing one less carbon atom. Both fractions were assayed for radioactivity.

4849 Mechanism of the Faworskii Reaction. Robert B. Loftfield. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p59-66.

A considerable number of α-halo; α, α'-dihalo; α,α-dihalo-; and α,β-dihalo-ketones have been observed to rearrange. One type of mechanism, the classic Faworskii rearrangement, has been studied here. The chloroketone, 2-chloro-1-cyclohexanone-1,2-C_1^{14}, was synthesized and rearranged by the Faworskii reaction to cyclopentane carboxylic acid. The reaction product was then degraded and radioassays were made on the key degradation products. The results are not final.

4850 Primary Processes Involving Radiobromine at the Carbon-Carbon Double Bond. R. R. Williams, Jr., W. H. Hamill, and H. A. Schwarz. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p67-77.

Kinetic studies are described which deal with the gas-phase hydrobromination of ethylene, induced by nascent Br^{80*}. The radiobromine was induced by neutron capture. The reaction occurs at constant concentrations of reagents, since only tracer amounts of bromine atoms are involved. Kinetics of the reaction were inferred from the competition between addition of Br* to ethylene and exchange with hydrogen bromide. Since the reaction bears a marked resemblence to the photochemical analog, it was treated as such, assuming a Maxwellian energy distribution among all particles excepting newly-formed Br*. 10 references.

4851 Detection and Identification of Free Radicals by the Use of Radiohalogens. William H. Hamill, Russell R. Williams, Jr., and Eugene E. Voiland. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p78-91.

Reactions of alkyl radicals with molecular halogens have been proposed as elementary reactions in a number of photochemical and thermal reactions. It has been presumed that all alkyl radicals will have similarly small activation energies for reaction with molecular halogens, and that, consequently, the most probable fate of any alkyl radical in a system containing molecular halogen will be formation of the corresponding alkyl halide. By the use of highly radioactive halogen, the derived alkyl halide will be radioactive, and the relative activity of various alkyl halides will be a measure of the relative amounts of the parent free radicals. The relative activities may be determined by subsequent addition of macroscopic amounts of the appropriate alkyl halides, followed by fractional distillation to separate pure samples of each. Activity determinations on each sample permit estimation of the nature and relative amounts of free radicals formed during the course of the reaction. This method was applied to the radiolysis of n-pentane with γ radiation from a Co^{60} source and subsequent reaction with iodine containing tracer amounts of I^{131}. In order to test the common presumption that photobromination yields only the alkyl bromides corresponding to the parent hydrocarbon, n-pentane was photobrominated using Br^{82} as the radioactive tracer. The bromination was carried out using light from a tungsten lamp filtered through $CuCl_2$. Reaction mechanisms are considered.

4852 Rearrangements of Carbon Atoms in t-Butyl and t-Amyl Derivatives. John D. Roberts, Robert E. McMahon, and Jack S. Hine. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p92-99.

Rearrangements of alkyl derivatives with polar catalysts have been studied using C^{14} as a tracer. These rearrangements involved substances of identical carbon skeletons and nearly identical energies. The starting compounds for the studies were 2-methyl-2-propanol-2-C^{14}, 2-methyl-2-butanol-2-C^{14}, and 2-methyl-2-butanol-1-C^{14}.

4853 Catalytic Hydrogenolysis. Elliot R. Alexander, A. G. Pinkus, and Fred W. Stone. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p100-104.

The term "hydrogenolysis" implies reaction with hydrogen in which cleavage of a molecule occurs. It has not been known whether the reaction involves a preliminary elimination step followed by hydrogenation or whether a direct cleavage of the bond is involved. An indication of the nature of the process may be gained by a study of the number of deuterium atoms introduced during deuterolysis, and a determination of the optical properties of the product may be obtained when the reaction is carried out at an asymmetric center. Results are summarized for the catalytic hydrogen-

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olysis of 1-methyl chloride and α-phenylethyl chloride, respectively.

4854 On the Mechanism of the Chemical Formation of Lactic Acid from Glucose Studied with C^{14} Glucose. Martin Gibbs. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p105-109.

In the investigation reported here, the mechanism of reaction proposed by Evans (Chem. Rev. 31, 537(1942)) was tested with the aid of C^{14} labeled glucose. Glucose-1-C^{14} and glucose-3,4-C^{14} were treated with 3N KOH for 48 hr; the lactic acid was isolated and degraded. The results were inconclusive.

4855 The Nomenclature of Organic Molecules Containing Isotopic Atoms. R. Christian Anderson. In Use of Tracers in Organic Reaction Mechanism Studies; Chemistry Conference No. 4; January 19-20, 1950. BNL-44, Mar. 1950. p110-129.

In this report the results of a discussion group which met on January 18, 1950 are considered. The problems requiring clarification are delineated, and a possible set of conventions are formulated.

4856 Determination of the Coefficient of Self-Diffusion of Sulfur by the Method of Isotopic Exchange. M. Haissinsky and D. Peschanski. J. chim. phys. 47, 191-7(1950) Mar.-Apr. (in French).

The kinetics of the exchange reactions between solid sulfur and polysulfide ions in aqueous solution between 100° and the fusion temperature is determined by the rate of self-diffusion in the solid. The authors have calculated the coefficients of self-diffusion for several temperatures, using radioactive S^{35} in conjunction with the method of isotopic exchange. The activation energy for the process is about 47,000 cal/mole. The activation energy for the exchange in molten sulfur is about 20,000 cal/mole. 14 references.

4857 The Exchange of Radioactive Zinc Between Cellulose and Sodium Hydroxide-Sodium Zincate Solutions. Karl Borgin and Alfred J. Stamm. J. Phys. & Colloid Chem. 54, 772-7(1950) June.

Radioactive Zn^{65} in the form of sodium zincate dissolved in concentrated sodium hydroxide can be rapidly removed from cotton by exchange into an inactive solution of identical concentration and by exchange into a more concentrated solution counter to the inward diffusion under a concentration gradient. In the latter case, inward diffusion hinders exchange for the first minute, while equalization of concentrations is occurring. Exchange during the next 4 min into the second solution is relatively faster, as more radioactive zinc remains in the cotton for exchange. Exchange into the third and fourth solutions is about the same. Diffusion into water is more rapid at first than the exchange into the same concentration of inactive solution because of the diffusion potential. Diffusion slows down, however, as both sodium hydroxide and sodium zincate are removed from the cotton as a result of the shrinkage of the cotton and a reduction in the cross section effective for diffusion. In no case do breaks occur in the curves that would result if slowly dissociating zinc compounds were formed. If compound formation does occur, the reaction must be

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more rapidly reversible than the exchange and the diffusion (96% complete in 5 min). 12 references. (auth)

4858 Isotopic Exchange of Atomic Bromine with Allylic Vinylic Halides. William H. Hamill, Russell R. Williams, Jr., and Harold A. Schwarz. J. Am. Chem. Soc. 72, 2813-4(1950) June. (Communication to the editor).

In the Szilard-Chalmers reaction producing Br^* by slow neutron capture, organic compounds which demonstrate a high efficiency for isotopic exchange of bromine are desirable for use as reagents. Results of experiments with various bromoolefins indicate their suitability for this purpose.

4859 The Entropy and Low Temperature Heat Capacities of Neptunium Dioxide. E. F. Westrum, Jr., J. B. Hatcher, and D. W. Osborne. AECD-2863, May 29, 1950, Decl. June 9, 1950. 1p.

The document is in abstract form; it is reproduced below in its entirety.

An adiabatic semimicrocalorimeter for measuring low temperature heat capacities of 0.01 mole samples of neptunium compounds was constructed. The cryostat was a modification of the design of Ruehrwein and Huffman (Jour. Am. Chem. Soc. 65, 1620(1943)) but employed only liquid helium and liquid nitrogen as refrigerants for measurements in the range 4 to 320°K. Temperature measurements were made with a strain-free platinum resistance thermometer which was an integral part of the calorimeter. Calibration of the thermometer was made possible by the kind assistance of H. M. Huffman, G. B. Guthrie, Jr., and others at the Bureau of Mines Petroleum Experiment Station. Heat capacity determinations were made on 2 g of neptunium dioxide prepared by Sherman Fried, J. C. Hindman, and J. G. Malm in this laboratory. There is a pronounced hump in the heat capacity curve at 25°K similar to the hump in the heat capacity curve of uranium dioxide at 29°K.

4860 Chemistry of Protoactinium. IV. Adsorption of Protoactinium from Hydrochloric Acid Solutions by Anion Exchange Resins. Kurt A. Kraus and George E. Moore. AECD-2866, May 31, 1949, Decl. Mar. 27, 1950. 10p.

It has been found that protoactinium can be adsorbed from strong HCl solutions on an anion exchange resin (Dowex A-1) and that the distribution coefficients vary sufficiently with HCl concentration to make purification of protoactinium with anion exchange columns possible. From qualitative considerations it is suggested that Pa(V) can form at least two negatively charged chloride complexes with probable charge −1 and −3 and possible formulas $Pa(H_2O)_2Cl_6^-$ and $PaCl_8^{-3}$. β-emitting Pa^{233} was used as a tracer in all experiments. (auth)

4861 The Melting Point and the Heat of Sublimation of PuF_3. Edgar F. Westrum, Jr., and James C. Wallmann. AECD-2873, May 19, 1950, Decl. June 28, 1950. 5p.

The following data were obtained experimentally: fusion temperature, 1426 ± 2°C; solidification temperature, 1425 ± 3°C; heat of sublimation, 89 kcal/mole at 1400°C. An equation for the dissociation pressure valid from 1200 to 1660°K was also obtained. X-ray diffraction examination

and spectrochemical analyses after the measurements confirmed the purity and phase of the PuF_3 and the absence of corrosion of the tantalum crucible used.

4862 The Potential of the Pu(III) - Pu(IV) Couple. The Hydrolysis Constant of Pu(IV). Sherman W. Rabideau and Joe F. Lemons. LADC-805, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

A study of the former potential of the Pu(III) - Pu(IV) couple has been made in various acids, over a range of activities, and at a constant ionic strength of unity. The formal potentials were obtained by an analysis of the potentiometric titration curves obtained by the oxidation of Pu(III) with Ce(IV). The value of this couple in 1M perchloric acid has been found to agree closely with that obtained by Connick and McVey (AECD-2455, 1948).

A value of the hydrolysis constant of Pu(IV) has been derived from a study of the variation of the potential of the Pu(III) - Pu(IV) couple with acidity and at a fixed ionic strength of unity.

4863 Magnetic Enhancement of Spectral Lines From Ions, with an Application to the Th IV-Spectrum. P. F. A. Klinkenberg. Physica 16, 185-97(1950) Mar.

It is shown that the tentative term 8 ^2P in the Th IV-spectrum given previously is correct. The wavelengths of the combinations with lower terms are accurately measured and the relative level values improved. The observed Zeeman patterns agree with theoretical anticipation within experimental error, assuming normal g-values. The σ-splitting of λ 6901 ($5\ ^2F_{5/2} - 6\ ^2D_{5/2}$) is determined more accurately than before. A few data concerning the spectrum of U VI are predicted from the isoelectronic sequence Ra II – Th IV – U VI. A description and qualitative explanation of the phenomenon of the magnetic enhancement of lines in ion spectra are given. (auth)

4864 Thorium Nitrate. IV. Leaching with Higher Alcohols and Ketones as a Means of Enriching Mixed Nitrates in Thorium. Charles C. Templeton and Norris F. Hall. J. Phys. & Colloid Chem. 54, 954-7(1950) June.

Mixed nitrates of thorium and rare earths may be enriched to more than 80% in thorium nitrate by leaching with any of several alcohols or ketones. The type of leaching considered consists in agitating the solid mixed nitrates with an appropriate amount of any of the higher alcohols or ketones. A batch of saturated solution is withdrawn and agitated with an equal volume of water until practically all the extracted nitrates enter the aqueous phase. The product is crystallized from the aqueous phase by evaporation and the washed organic solvent saved for re-use. The attainable thorium enrichment increases within an homologous series of alcohols or ketones with increasing molecular weight. (auth)

4865 Thorium Nitrate. V. Extraction from Aqueous Solution by Organic Solvents as a Means of Enriching Mixed Nitrates in Thorium. Charles C. Templeton and Norris F. Hall. J. Phys. & Colloid Chem. 54, 958-63(1950) June.

It was shown by the authors (J. Phys. & Colloid Chem. 54, 954-7(1950) June) that the leaching of mixed solid thorium and rare earth nitrates with higher alcohols and ketones results in a considerable increase in the proportion of thorium nitrate. The present paper demonstrates that the last 10 to 20% of rare earth nitrates can be removed by a liquid-liquid extraction process. The only condition which is critical to the process is that the starting aqueous solution must be kept quite near to saturation with respect to thorium nitrate.

4866 The Use of Ether Extraction for the Analytical Separation of Uranium. N. H. Furman, R. J. Mundy, and G. H. Morrison. AECD-2861, nd. Decl. June 21, 1950. 20p.

The study of the behavior of various salting or addition agents in causing uranyl nitrate to be effectively distributed from aqueous solution into diethyl ether has led to its application to analytical problems. The distributions of the majority of the elements of the periodic system along with uranium under certain conditions have been measured as a guide to their behavior in an analytical scheme. Analysis of high grade materials is most effectively performed by means of a continuous extraction using ammonium nitrate as the salting agent. Low grade products are best extracted in a separatory funnel using calcium nitrate as the salting agent. The final determination of the uranium is made by a sensitive method, as for example, colorimetric or polarographic. Effective continuous extractors of various designs have been constructed and tested. Both single and multiple effect extractors have been used. The ether method is in good agreement with the standard cupferron-ceric method for various products ranging from less than 1% up to 97% black oxide (U_3O_8). (auth)

4867 The Fluorophotometric Determination of Uranium. George R. Price, Renato J. Ferretti, and Samuel Schwartz. AECD-2870, Apr. 1947, Decl. Feb. 1, 1950. 90p.

The brilliant yellow-green fluorescence of uranyl salts provides a means for uranium determination which offers advantages possessed by few other analytical methods for any element. The analytical system in use at the Argonne National Laboratory (April 1947) is described as follows:

From an unknown solution an aliquot of 0.005 to 0.1 ml is pipetted into a shallow platinum dish about 1.5 cm in diameter, and evaporated to dryness under a heat lamp. If a large residue of readily volatilizable or decomposable material remains, the sample in the dish is heated in a flame; only rarely is any other type of purification employed. To the dry residue in the dish approximately 0.3 g of sodium fluoride or sodium fluoride-sodium carbonate mixture is added, and the salt is fused by holding the dish in the flame of a Meker burner or by mounting it on a gas stove. After cooling, the disc of fused salt, either still in the platinum dish or "tapped out" from the dish, is irradiated with light from the 365 mμ mercury line, and the yellow-green fluorescence is measured by a photoelectric fluorophotometer. From the reading obtained for the fluorescence of the sample, the average value for the fluorescence of blanks is subtracted, and the difference is multiplied by a previously determined calibration factor to give the amount of uranium in the sample. If there is reason, because of the presence of color in the fused flux or from knowledge of the compo-

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sition of the solution being analyzed, to suspect interference with the fluorescence, one can to a considerable degree remove this quenching by dilution, by employing a smaller aliquot, or can correct for it by "spiking", by adding a known amount of uranium to an identical aliquot in another dish. The useful range of the method is for a sample size of from about 10 to 0.0001 μg of uranium; work below 0.001 μg requires great care in avoiding contamination. Usually analyses are run in duplicate; for routine work the standard error of the mean of the pair is generally below 10% except when the sensitivity is near its limit or when unusually large amounts of interfering substances are present, and by employing certain refinements in technique it is frequently possible to reduce the standard error to less than 5%. No element besides uranium has been shown to produce detectable fluorescence under the conditions recommended in this paper. Included also are a survey of work at other laboratories, sensitivity, accuracy of various experiments, and detailed instructions for the analytical procedure.

4868 Magnetic Susceptibilities of Some Uranium and Plutonium Salts. Norman Elliott and W. Burton Lewis. LADC-806, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Magnetic susceptibilities of several uranium and plutonium salts have been measured over the temperature range 75 to 300°K. The susceptibilities follow the Weiss-Curie Law $\chi = c/T + \Delta$ with Δ varying between 100 and 400°. The magnetic moments calculated from these data are not in agreement with the theoretical values for free ions involving 5 f electrons or with the "spin only" moments.

4869 A Contribution to the Study of the Solubility of Uranyl Nitrate in Organic Solvents. W. L. De Keyser, R. Cypres, and M. Herrmann. Bull. centre Phys nucl. univ. libre Brux. 1950, No. 17, Apr. 13p. (in French).

The solubility of $UO_2(NO_3)_2$ in various ethers, esters, alcohols, and ketones at 20° is reported. The water-uranyl nitrate-ethyl acetate system was studied in great detail. The variation of the partition coefficient, and the ternary composition in each phase at constant temperature as a function of the salt concentration, and the variation of the partition coefficient, at constant salt concentration, as a function of the equilibrium temperature, were measured.

4870 Determination of the Melting Point of Uranium. Albert Allendörfer. Z. Naturforsch. 5a, 234-5 (1950) Apr. (Brief note, in German).

By means of distillation in a high vacuum pure (99.96%) uranium was produced. The melting point of the purified product was found, thermo-electrically, to be 1090 ± 2°C.

4871 Dielectric Properties of the Uranium Oxides UO_2, U_3O_8, UO_3. Marie Freymann and Rene Freymann. Compt. rend. 230, 2094-6(1950) June 2 (in French).

Radiofrequency absorption measurements were made with UO_2, U_3O_8, and UO_3 at temperatures ranging from +20 to −160° and for the frequencies: 1, 2, 5, 10, and 16 kc. The absorption is plotted as a function of temperature for families of curves representing these frequencies. The results are: (1) UO_2 has zero absorption; (2) UO_3 shows a strong absorption which decreases rapidly as the temperature is lowered; (3) the absorption curve for U_3O_8 goes through a minimum and then a maximum as the temperature is lowered, which cannot be attributed to an electronic origin. Further studies of uranium oxides intermediate between UO_2 and UO_3 are in progress.

4872 Radioactive Intensifying of Spectral Lines. Salomon Rosenblum. Compt. rend. 230, 1766-7 (1950) May 15 (in French).

It is known that uranium salts are used in photography as intensifiers of the darkening. Since uranium is radioactive, a film so intensified can be used for the reproduction of the photograph by applying the film against a photographic plate sensitive to α-rays. Unfortunately, owing to the weak radioactivity of uranium such reproductions require very long exposures (days and months). The authors added 10 to 15 μg of plutonium (as nitrate) to an intensifying solution containing 10 mg of uranyl nitrate. Tests were made with photographs of a strong spectral line of thorium B (Pb^{212}) and of three lines of actinium. Good reproductions were obtained in a few hours. The authors think that β emitters could probably be used for the same purpose, and that a photometry of α- or β- intensified photographs, utilizing counters or track-counting, could be devised.

4873 Spectrographic Analysis of Uranium. A. Walsh. Spectrochim. Acta 4, No. 1, 47-56(1950).

A tentative method for the spectrographic determination of impurities in uranium has been developed (1945), using an "arc-like" discharge between metal electrodes, and an estimate is made of the degree of accuracy and sensitivity obtainable. All the quantitative data so far available are limited to the determination of iron, silicon, manganese, copper, and nickel, but it is anticipated that the technique described will be applicable to other impurities. Suggestions are made for further improvement of the method. (auth)

4874 The Spectrographic Determination of Silicon in Uranyl Nitrate Solutions. F. T. Birks. Atomic Energy Research Establishment Report No. AERE-C/R-515, Apr. 1950. 4p.

Silicon was determined to an accuracy of ±10% within the range 10 to 5,000 ppm by a complete burn procedure on U_3O_8, using the uranium line, 2519.0 A, as internal standard for the analysis line of silicon, 2516.1 A. Risks of contamination in handling were reduced by evaporation and ignition of the samples directly on graphite electrodes. (auth)

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4875 An Investigation of Specifications and Ratings of Commercial Air Cleaners. G. S. Reichenbach, Jr., Leslie Silverman, and Philip Drinker. NYO-1517, July 1, 1949. 20p.

This report presents a study made by Harvard University to determine the type and scope of information available from manufacturers of air cleaning and dust collection equipment. More than 40 manufacturers were contacted, principally those listed in the American Society of Mechanical Engineers, 1948 Mechanical Catalog.

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4876 Air Filters; Simplification of the Glass Fiber Mounting. M. D. Thaxter. UCRL-672, Apr. 19, 1950. 10p.

Very fine (1.3 μ diameter) glass filaments, lightly bonded with synthetic resin into a low density mat (0.6 lb/cu ft) has been demonstrated to be an efficient collector of aerosols when used as an air filter. Its employment in a pleated form has been hampered, however, by the difficulty of mounting and edge-sealing to prevent leakage and to provide support for the relatively fragile mat. This difficulty has been overcome by sandwiching the mat edge between the two pieces of wood obtained by jig-sawing an undulating curve conforming to the desired pleat pattern. Two sandwich-supports thus formed become the opposing sides of a box enclosure. Such enclosures have been used successfully as internally-loading dust filters. The assembly has the desired advantage of resisting chemical fumes which attack paper air filters and of being easily disposable without spreading contaminants. (auth)

4877 Heat Transfer by Natural Convection from Horizontal Cylinders to Liquid Metals. Third Quarterly Progress Report for January 1, 1950, to March 31, 1950. Seymour C. Hyman and Charles F. Bonilla. NYO-559, Mar. 31, 1950. 8p.

Heat transfer coefficient data have been obtained at Columbia University with silicone fluids covering a range of viscosities. Preliminary data have been obtained using a 1-in. diameter cylinder. An inconclusive attempt was made to detect the effect of a nonwetting surface on heat transfer. (auth)

4878 An Autoradiographic Method in the Study of Segregation in Steel. Andre Kohn. Compt. rend. 230, 2201-3(1950) June 19 (in French).

A method is described whereby the segregations of elements in steel can be studied by autoradiographs using 2 methods: (1) irradiation with neutrons of the element to be studied and introduction of it into the steel specimen; (2) exposure of a specimen in the slow neutron pile. The presence of other elements in the steel is not particularly troublesome, with the exception of chromium which emits γ rays and causes a reduction in definition.

4879 An Inexpensive Vacuum Valve. David Okrent. AECU-841, nd. 2p.

This is not an abstract; the document is reproduced below in its entirety.

It is common practice to use commercial refrigerator valves in vacuum systems. The desirable characteristics of these valves include low cost and apertures at least as large as the line. Usually, the valves are modified with some considerable labor to make them suitable for vacuum work. This communication reports the use of such a valve for vacuum work, simply modified by a Teflon insert.

Recently, Superior brand packless refrigeration valves (¾ and 1⅛-in. tube diameter) were installed in a high-speed, kinetic vacuum installation which must be opened several times daily (7-liter volume, working vacuum of 5×10^{-5} mm Hg). This type of valve uses a multiple metal replaceable diaphragm to seal the atmosphere from the vacuum. The seal between the two parts of the vacuum system is provided by a plastic disk insert which seats against a metal ring.

The valves initially leaked across the plastic disk insert. As a quick fix, neoprene rubber sheet was cemented directly to the top of the insert. But, after a short time the metal ring seat cut through the surface of the neoprene, even without extraordinary pressure.

The original hard plastic inserts were then removed and new inserts, cut from Teflon sheet, were pressed in. The valves then proved very satisfactory. Teflon is a tough, soft plastic characterized by chemical inertness and low vapor pressure; ordinary hand tightening is sufficient to achieve a seal.

For the first six weeks, three modified valves were completely satisfactory. After that time one of the valves, the oil-pump bypass valve, which is normally closed and frequently used, required excessive tightening to provide a satisfactory seal. Examination of the Teflon showed that a groove had been worn in it, and the insert was replaced. No further difficulties have arisen during several weeks of additional use.

The original press-fit seat insert or the Teflon can be removed by a simple lathe operation. If the Teflon insert is made slightly oversize it will trim itself to size automatically when pressed into place. Thirty minutes are sufficient for the entire alteration.

We have followed the practice of applying vacuum grease to the sealing surfaces of the metal diaphragm upon installation, though this may be unnecessary. Naturally, care must be taken to keep the sealing surfaces clean.

Desirable features of this type of valve are (1) unrestricted flow area equal to, or in excess of line sizes; (2) ease of making sturdy and reliable solder joints to brass or copper tubing; and (3) all internal parts are easily removable.

4880 The Differential Tetrode Ionization Gauge Leak Detector. J. E. Johnson. Atomic Energy Research Establishment Report No. AERE-G/R-479, Mar. 1950. 10p.

Experiments with two tetrode ionization gauges used differentially are described. The control grid in the tetrode gauge allows a much simpler circuit to be used for controlling the electron current than that required for a triode ionization gauge. The main factors governing the choice of the probe gas and the trapping system are discussed. The relevant data for carbon dioxide and butane, the two most suitable probe gases, are given. Using carbon dioxide it was found that the quantity of soda lime required to give 80% absorption of the probe gas made the time required to get a pressure of 10^{-5} mm in the ionization gauge inconveniently long. It is thought that a cold trap is a better means of absorbing the probe gas. The differential use of the tetrode ionization gauges reduced the minimum detectable pressure change by a factor of 10. This compares favorably with the reduction obtained by the use of differential triode ionization gauges with specially stabilized circuits. In the experiments described the ultimate minimum detectable pressure change was 2×10^{-8} mm. This limit could probably be decreased by increasing the stability of the amplifier and by increasing the stabilization and matching of the tetrode ionization gauges. (auth)

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4881 A New Pirani-Type Vacuum Gauge. E. Blasco and L. Miranda. Rev. Sci. Instruments 21, 494-5 (1950) May.

The author describes the design and operation of a Pirani-type vacuum gauge incorporating two new features which make the instrument more reliable. The filament of the Pirani gauge is covered with a fine capillary tube to prevent the accumulation of carbon deposits on the filament. Such deposits would otherwise affect the characteristics of the gauge. Provisions are also made to counteract the effects of variations in the line voltage.

4882 A Philips-Type Ionization Gauge for Measuring of Vacuum from 10^{-7} to 10^{-1} mm of Mercury. Ernest C. Evans and Kenneth E. Burmaster. Proc. Inst. Radio Engrs. 38, 651-4(1950) June.

A Philips (Penning)-type ionization gauge is described which, unlike most former gauges of this type described in the literature, is capable of measuring vacuum down to 10^{-7} mm of Hg. Construction and operation details of the gauge are given in addition to its advantages and disadvantages as compared to hot-cathode-type ionization gauges. (auth)

4883 The Principles of Leak Detection. A. H. Turnbull. Atomic Energy Research Establishment Report No. AERE-G/R-478, Mar. 1950. 27p.

The report discusses dynamic methods of leak detection where the surface of a continuously evacuated system is probed with a jet of some gas or vapor which is not initially present to any appreciable extent in the system. Leak detection with the detector on the high vacuum side and on the backing side of the main diffusion pump are discussed, and equations are derived for the partial pressures of air and probe gas in the system at any time. Optimum leak detection conditions are determined and data are given enabling the minimum detectable leak to be calculated when certain detectors and probe gases are used in any system. (auth)

4884 Suppressing Mercury Vapor in Vacuum Systems. Frederick Ayer II. Rev. Sci. Instruments 21, 496(1950) May.

It is sometimes necessary to exclude mercury vapor from vacuum systems which are designed to operate at any pressure between atmospheric and 10^{-4} cm Hg. In such a system, the most convenient combination of pressure-measuring instruments is a mercury manometer for pressures down to about 2 mm, coupled with some other device such as a vacuum thermocouple. Mercury vapor may then be prevented from diffusing from the manometer into the system by floating a layer of some low-vapor-pressure oil of the Apiezon "B" type on the mercury surface to a depth of perhaps 3 cm. In cases where determination of the absolute pressure in a system is necessary, equal amounts of oil may be floated on both mercury surfaces. If left to itself without continuous pumping, the system will contain, at equilibrium, both mercury and oil vapors, but as the rate of diffusion of mercury vapor through the oil layer is very slow, its concentration will be greatly lowered when the system is evacuated by large-capacity pumps. Several precautions necessary in the application of this method are discussed.

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4885 Progress Report for January 1 to March 31, 1950. F. H. Norton, D. M. Fellows, M. Adams, and M. McQuarrie. NYO-594, Mar. 1, 1950. 22p.

Results are given in this Massachusetts Institute of Technology report for the measurement of thermal conductivities in low and intermediate temperature ranges on sintered alumina and on insulating firebrick. A new method is described for obtaining optical pyrometer readings down small holes. This method eliminates the problem of diffraction. The determination of power consumption in inductively heated thermal conductivity test apparatus is discussed.

4886 Some Preliminary Work on the Manufacture and Sintering of Dense Beryllia Shapes. R. F. Walker. Atomic Energy Research Establishment Report No. AERE-CE/R-440, Dec. 1949, 15p.

This report describes in full the details of a method of slip-casting beryllia, and suggests other methods of fabricating shapes. Some experiments on the sintering of beryllia have been completed indicated that a better and faster sintering can be achieved than previous evidence has suggested by sintering in an argon atmosphere in the presence of graphite. A tentative explanation of this phenomenon is given. (auth)

4887 A General Interpretation of the pH-Viscosity Relationship for Amphoteric Ceramic Oxide Slips. P. Murray. Atomic Energy Research Establishment Report No. AERE-M/R-507, Apr. 1950. 18p.

The pH-viscosity and pH-sedimentation volume relationships have been determined for concentrated uranium dioxide (UO_2) slips and show a marked similarity to each other and to the pH-viscosity curve obtained by other workers for alumina. The shape of the curves for uranium dioxide are tentatively explained on the assumptions that uranium hydroxide possesses amphoteric characteristics and that the solid particles of the slip can adsorb complex metal anions or cations. Calculations based on this hypothesis give pH-neutralization curves which agree with the experimental viscosity and sedimentation curves. An analogy has been noted between this phenomena and the pH-solubility curve for silver oxide. Satisfactory uranium dioxide crucibles can be made by slip casting at pH 2.1. (auth)

4888 Porosities Can be Obtained from Radioactivity Logs in West Texas. Example of Quantitative Technique Shown for Scurry County. R. E. Bush. Oil Gas J. 48, 153-65(1950) Apr. 27.

It is shown that a radioactive log may be used as a means of determining porosity within a field or area by selecting a cored well which has been logged by radioactivity logging devices as the base well from which a neutron derived porosity curve and a γ-ray subtractive curve may be determined. These curves may then be applied to uncored or unknown wells that have the same bore hole diameter and casing program as the base well after proper consideration of log sensitivity has been made. For wells having a different bore diameter or casing program, other base determinations must be made until all conditions existing in the field have been satisfied. While these methods are not based on absolute measurements, they approach absolute measurements very closely and offer the advantage of

rapid conversion to absolute measurements when they are available. All examples discussed are based on a number of quantitative interpretations of radioactivity logs of wells in the Scurry County, Texas, Canyon reef limestone, and the neutron derived porosity curve shown is applicable to the radioactivity of logs of other uncased wells in this area drilled to 6-¾ in. diameter. (auth)

4889 The Radioactivity of the Earth. C. Festa and M. Santangelo. Ann. geofis. 2, 503-17(1949) Oct. (in Italian). (See also NSA 3-337.)

After reviewing recent work on the distribution of radioactive minerals in the earth's crust, the authors consider its bearing on the problems of the age of the earth and of the geothermal gradient. For the former they accept Holmes' figure of 3.35×10^9 yr as the most reliable. The geothermal gradient of about 30°C/km could, they suggest, be caused by a layer of granite of 10 to 20 km thickness. The most urgent need is for further experimental data.

4890 The Powder Metallurgy of Beryllium. H. H. Hausner and N. P. Pinto. AECD-2869, Mar. 24, 1949, Decl. Aug. 23, 1949. 65p.

It has been generally considered that beryllium is nonductile. Theoretical considerations however show no reasons for a fundamental nonductility of this metal in the pure state; the observed brittleness may be due to impurities. Studies concerning the powder metallurgy of the commercial available beryllium powder showed that the powder can be pressed and sintered without any difficulty. By sintering the beryllium compacts in purified argon a material of approximately 90% of the theoretical density was obtained. This material was brittle. Sintering in high vacuum revealed a material of similar density (porosity), but these vacuum sintered compacts were slightly ductile; a bar approximately ⅛ in. thick could be bent slightly, and a reduction in thickness of 8 to 10% by cold rolling was possible and accompanied by mechanical twinning. After annealing of the vacuum sintered cold rolled beryllium specimens, the mechanical twins disappear and the specimens can be cold worked again. It is thought that a migration of beryllium atoms occurs during the evaporation of the material in high vacuum, which effects not only the sintering conditions but also creates a certain ductility. The report contains data on the powder metallurgy of beryllium, data on the evaporation during sintering in high vacuum, and further data on some properties of the material in various stages, such as electrical resistivity, hardness, and other physical properties. (auth)

4891 Local Order in Solid Cu_3Au. R. A. Oriani. GEPM-22, May 1950. 8p.

The existence of both x-ray and activity data at overlapping temperatures for solid Cu_3Au makes possible the direct comparison of the degree of local order as calculated by the chemical method of Takagi (Physico-Math. Soc. Japan, 23, No. 1, 44(1941)) and Birchenall (A.I.M.E. Tech. Pub. No. 2169 (1947); Metals Trans. 185, 428(1949)) with that given from the x-ray studies. The details of the calculation are summarized, and the agreement between the two methods is found to be satisfactory. (auth)

4892 Thermodynamics of Metallic Solutions; Technical Progress Report No. 3, Scope 1. J. Chipman and G. Scatchard. NYO-568, Mar. 31, 1950. 4p.

In this brief status report from the Massachusetts Institute of Technology, the following activities are reviewed: effect of a third component on the chemical activity of sulfur in liquid iron; ternary liquid-metal systems (Cd-Pb-Sb, Cd-Pb-Bi, Cd-Sn-Bi); vapor pressures of alloy systems; theoretical studies concerning activity coefficients in ternary alloys.

4893 Removal of Gaseous Embrittlement from Zirconium (Progress Report). Donald Wroughton and William C. Lilliendahl. NYO-1014, Jan. 23, 1950. 3p.

Preliminary results are reported by the Westinghouse Electric Corporation on the removal of dissolved oxygen and nitrogen from zirconium metal by heat treatment in molten calcium.

4894 Alloys for High-Temperature Service; Quarterly Progress Report. Howard C. Cross. Battelle Memorial Institute, June 16, 1949. 21p. (AEC File No. NP-1414.)

This report summarizes the work done during March through May 1949. The program to improve the room-temperature shock resistance of chromium-base alloys has been started. The vacuum-melting apparatus has been modified to facilitate the preparation of low-oxygen and low-carbon alloys; these will be used to study the effect of oxygen and carbon on shock resistance. Carbon monoxide vapor-pressure data are being collected to permit thermodynamic calculations for the reaction: O(in Cr) + C(in Cr) $\rightleftharpoons$ Cr + CO. Nine chromium-base alloy heats were prepared in the vacuum apparatus using various carbon additions and different holding times for the alloys in the molten state. Bend tests were conducted on eight of these heats. There appeared to be no correlation between observed deflections or calculated maximum bending stresses (in tension at the outer fibers) and either of the above-mentioned variables. However, it was observed that the relationship between ASTM grain size and breaking stress was linear. Slip lines were visible adjacent to the fractured surfaces of the bend-test bars. These indicate that chromium-base alloys have some ductility and give hope of increasing the shock resistance of this material. A few tests were run on the investment casting of chromium-base alloys as turbine blades. Several previously prepared heats were tested in creep rupture at 1600°F and 33,000 and 40,000 psi. Only seven bars withstood the test stresses for more than 100 hr. No additional heats are being made up for testing until the program on shock resistance produces some indication of how to improve this property of chromium-base alloys. The investigation of the effect of nitrogen on the alpha-beta transformation and on the precipitation of gamma phase in cobalt-rich cobalt-chromium alloy was completed. (auth)

4895 The Rarer Metals. W. H. Dennis. Mine and Quarry Eng. 16, 173-8(1950) June.

A presentation of the occurrence and production of the rarer metals is given. The metals discussed are lithium, cesium and rubidium, beryllium, indium, thallium, and thorium. Flow sheets are shown for the production of beryllium, indium, and the extraction of thorium from monazite.

The disintegration of thorium produces a material known as radioactive mesothorium, and, because of this, the two are always found associated. Mesothorium possesses a half-life of 7 yr. Mesothorium in turn disintegrates into a product known as radioactive thorium having a half-life of 2 yr.

4896 Some Properties of Tantalum. Rupert H. Myers. Metallurgia 41, 301-4(1950) Apr.

An investigation of the effect of deformation and annealing on some mechanical and physical properties of tantalum has been made and the phenomenon of hardening of tantalum when heated in an imperfect vacuum has been described and studied. Deformation lowers the softening temperature from 650 to 450°C, but has no effect on the electrical resistivity. Tantalum absorbs gases strongly at approximately 1800°C, but they can be removed by heating to temperatures above 2200°C. The absorption of gas by tantalum is accompanied by increases in hardness, electrical resistivity, and lattice parameter. Gas-hardened tantalum retains its hardness and chemical resistance to attack by many reagents after heating in a high vacuum up to about 1800°C. The hardening process should be useful for making corrosion and erosion resisting nozzles and dies. Some of the mechanical properties of tantalum have been determined, and the effect of deformation on these has been studied. Deformation has no effect on the electrical resistivity but it lowers the softening temperature from about 650 to 450°C.

4897 Titanium-Chromium Binary Alloys. M. G. Fontana. Ohio State University Research Foundation Report No. AF-TR-5946, May 1950. 78p.

This project was concerned with the preparation and properties of binary alloys of chromium and titanium, with special emphasis on the arc furnace production of the alloys and property evaluation within the titanium-rich, forgeable-alloy range. Approximately 65 arc melted alloys and 30 induction melted alloys were prepared to evaluate charge materials, melting techniques, crucible materials, and alloy properties. The arc furnace proved to be the more efficient apparatus for the production of alloys for property evaluation. Induction furnace work was continued to evaluate refractory containers for application to this system of alloys. The outstanding property of the forgeable titanium-chromium alloys is very high room-temperature strength in combination with low specific gravity. Titanium was greatly improved in this respect by chromium additions. The tensile strength of titanium was nearly doubled by additions of 13 to 18% chromium with little loss of ductility and only slight increase in weight. (auth)

4898 Toughness of Titanium. R. K. Pitler and L. D. Jaffe. Metal Progress 57, 776-8(1950) June.

The commercially pure titanium and its alloy tested by notched-bar impact tests exhibit transitions from brittle to tough behavior, of the type found in steel and certain other metals. The impact strength increases with increasing temperature over a moderately narrow temperature range. The temperature range is usually at higher temperatures for titanium than for properly heated-treated alloy steel of the same strength. The approximate transition temperatures (V-notch Charpy test) for the titanium tested are as follows:

Titanium produced by powder metallurgy, and rolled	925°F
Titanium melted, cast, and forged	1000
Titanium-chromium-aluminum alloy	1250

The strain hardening exponent of titanium is approximately 0.14, at a strain rate of 0.0008/sec. This strain hardening is about the same as for steel but lower than for copper. (auth)

4899 Zirconium and Its Compounds. A. E. Williams. Mining J. (London), 44-9(1950) May (Annual Review Number).

The production of zirconium is briefly discussed and the uses and applications of zirconium compounds are given. Some of the points covered are zirconia in the ceramics industry, synthetic zircon, and the grain-refining effect of zirconium on magnesium alloys.

4900 Accuracy of Radioassays Obtained with Improved Automatic Sample Changer. James H. Pannell. MITG-A82, July 22, 1949. 11p.

Tests were run for the purpose of determining the accuracy of β-ray measurements made on an automatic sample changer. The results obtained on low-grade uranium and thorium ores are described in this report which includes some details of the sample changer itself. The automatic sample changer proved to be sufficiently accurate for the radioassay of ores containing as little as 0.024% U_3O_8 or 0.05% ThO_2. Sources of error in the original design have been eliminated by mechanical and electronic improvements.

4901 Preliminary Experiments on the Gamma, N Reaction for Analyzing and Picking Beryl. James H. Pannell and Wilfred L. Freyberger. MITG-214. 31p.

This report contains the results of preliminary experiments intended to assess the (γ,n) reaction as a means for automatically picking beryl and analyzing for beryllium. Sufficient neutron activity was produced with 1 g of radium to indicate its usefulness in analyzing material containing as little as 0.01% BeO. Work with the 1-g source was seriously hampered by its high neutron background. A ratio of 5:1 for total counting rate to background was the maximum obtained with 300 g of 100% beryl. The Trump-Van de Graaff x-ray generator produced intensities of 100 cpm/g of beryl with a background of less than 1 cpm. It is estimated that with the x-ray generator, 5-g pieces of beryl at the rate of 1/sec could be picked. (auth)

4902 The Distribution of Radioactivity in Volcanic Rock. I. Granite of Lake Blanc (Vosges). E. E. Picciotto. Bull. centre phys. nucl. univ. libre Brux. 1950, No. 16, Mar. 18p. (in French).

The main minerals in the rock studied are quartz, or those, albite, and biotite. Secondary in importance are zircon, sphene, and apatite. The technique used in mounting the specimen and the photographic plate used in recording the α tracks is described. Tables giving the over-all α activity of the main minerals and the detailed distribution on a microscopic scale of the activity in each mineral, taking into account the presence of foreign materials, are shown and discussed as well as the role played by Ca, Y, Zr, and the rare earths in concentrating traces of U and Th in the minerals.

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4903 The Fluorescence Spectra of Uranium Minerals in Filtered Ultraviolet Light. H. Haberlandt, F. Hernegger, and F. Scheminzky. Spectrochim. Acta 4, No. 1, 21-35(1950).

A survey of the fluorescence spectra of various uranium minerals leads to a new classification of the spectra into five groups which show some relationship with the chemical constitution of the minerals. By rewriting some of the formulas the discontinuous band spectra can be related to the uranyl complex and the continuous fluorescence spectra ascribed to a uranate-uranyl complex. Finally the part played by the anions, cations, and water of crystallization in the intensity and spacing of the fluorescence spectra is indicated. (auth)

4904 A Survey of the Uranium Resources of the World. Frederick Haeberle. Texas J. Sci. 2, 148-55(1950) June 30.

The various uranium minerals and their geologic distribution are briefly described. The three most productive areas at present are the Katanga region of the Belgian Congo, Great Bear Lake in Canada, and Joachimsthal in Czechoslovakia. In all three deposits the ore occurs in veins cutting Precambrian sedimentary rocks, is associated with cobalt, and the principal gangue minerals are quartz and carbonates.

4905 The Fine Structure of Singly Ionized Helium. Willis E. Lamb, Jr., and Miriam Skinner. Phys. Rev. 78, 539-50(1950) June 1.

The displacement $2^2S_{1/2} - 2^2P_{1/2}$ in singly ionized helium has been determined to be 14,020 ± 100 mc/sec. The method is analogous to that employed for hydrogen by Lamb and Retherford, except that no beam of metastable ions is formed. Instead, helium atoms are bombarded by electrons of a few hundred volts energy. In about 1% of the ionizing collisions, the remaining atomic electron is excited to the metastable $2^2S_{1/2}$ state of the ion. When the bombardment region is illuminated with microwave radiation of the proper frequency, transitions to the $2^2P_{1/2}$ state are induced, and the ultraviolet photons emitted in the subsequent decay to the ground state $1^2S_{1/2}$ are detected by a suitable photoelectric detector. Background effects due to metastable atoms and radiation from He(I) are reduced by the use of a collodion film filter. The experimental value for the $2^2S_{1/2} - 2^2P_{1/2}$ level shift is about 1.4% higher than the present theoretical value. (auth)

4906 Statistical Mechanics of Liquid Mixtures of He^3 and He^4. J. De Boer and C. J. Gorter. Physica 16, 225-38(1950) Mar.

In order to account for their vapor pressure measurements on dilute mixtures of He^3 in He^4, Taconis, et al (Physica 15, 733(1949)) suggested that He^3 dissolves only in the normal part of He^4 and not in its superfluid part. On the basis of this suggestion, the statistical mechanics of these mixtures has been developed. Two different assumptions about the fraction of the He^4 which is in the normal state have been considered. According to assumption A, this fraction adjusts itself in the mixture in such a way that Gibbs' function is a minimum, whereas, according to assumption B, this fraction is independent of the He^3 concentration. Case A leads to a λ point which decreases with rising He^3 concentration. Case B, on the other hand, leads to a transition of the first order and to a decomposition of the mixtures into two co-existing phases below the λ temperature of pure He^4. Accepting provisionally the expression for Gibbs' function of He^4 which corresponds to Tisza's special version of the two fluid model, a few computations have been made about expected transition lines and vapor pressures. A comparison is attempted with Stout's approach (Phys. Rev. 76, 864(1949)) to the same problems. (auth)

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4907 Trivalent Cations in Fluorescent Zinc Sulphide. F. A. Kröger and J. Dikhoff. Physica 16, 297-315 (1950) Mar.

Incorporation of monovalent cations in a lattice consisting of divalent ions is only possible to an appreciable extent when the lack of positive charge resulting from the substitution of a monovalent cation for a divalent one is compensated for. This compensation can be effected by a simultaneous incorporation of monovalent anions or of cations of a valency higher than 2. On this basis it is explained that ZnS becomes fluorescent by the monovalent activators Ag^+, Cu^+, Au^+, and Zn^+ when halogens or trivalent cations are present. Some of the trivalent ions incorporated in this way are found to cause effects of their own (electron traps, fluorescence, killing of fluorescence due to the other centers). An atomic model of the centers of fluorescence is given.

4908 Ultraviolet Emitting Phosphor. Rudolph Nagy, R. W. Wollentin, and C. K. Lui. J. Electrochem. Soc. 97, 29-32(1950) Jan.

A calcium zinc phosphate phosphor activated with thallium has been developed for the generation of ultraviolet radiation and is especially rich in erythemal region. The peak of emission of this phosphor is dependent upon the ratio of the calcium to zinc. A phosphor in which 8% of calcium is replaced by zinc in calcium phosphate has a peak emission at 3120 A, or very near that of maximum erythemal effectiveness. Forty-watt fluorescent lamps made with this new phosphor in ultraviolet transmitting glass (9821) produced 7.5 to 8.7 w of ultraviolet radiation between 2800 and 3800 A with a peak emission at 3120 A. The weighted erythemal effective radiation from this lamp is from 1300 to 1750 mw, or about 2.5 times the effective erythemal radiation from calcium phosphate activated with thallium. When it is considered that these lamps operate from an ordinary fluorescent ballast and are more efficient than any other source in producing erythemal radiations, a new avenue of approach is open for bringing the benefits of sunlight into schools, offices, and factories. (auth)

4909 Interstellar Magnetic Fields. Arnulf Schlüter and Ludwig Biermann. Z. Naturforsch. 5a, 237-51(1950) May (in German).

Interstellar magnetic fields are explained as due to the turbulent motion of gaseous matter. The authors discuss the mechanism of the turbulence and the magnitude of the resultant magnetic field. It is shown that these fields are such as to be compatible with the observed distribution of interstellar absorption lines, and that they can explain the largely isotropic distribution of cosmic radiation.

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4910 On the Thermal Conductivity in Dense Stars. L. Mestal. Proc. Cambridge Phil. Soc. 46, 331-8 (1950) Apr.

In stars of small mass, where the temperatures are comparatively low and the densities high, the conductivity of the degenerate or semidegenerate electron gas plays an important role, especially in white dwarf stars. An expression for the thermal conductivity under such conditions is derived, subject to the restriction that it applies only to an assembly in which the important interactions between the electrons and the nuclei are those that give rise to no energy exchange. Asymptotic formulas for high and low degeneracies are given, and their ranges of application are estimated. For the intermediate range a set of results, sufficient for interpolation, has been computed. Numerical calculations were made for a star consisting mainly of hydrogen and situated at the low luminosity end of the main sequence.

4911 The Production of Neutral Mesons by Photons. K. A. Brueckner and K. M. Watson. UCRL-679, Apr. 26, 1950. 7p.

This is not an abstract; the document is reproduced below in its entirety.

A number of recent experiments at Berkeley have given independent and strong support for the hypothesis that there exists a neutral meson which is strongly coupled to nucleons. Of particular interest are the experiments of Steinberger, Panofsky, and Steller which seem to indicate that neutral mesons can be produced by photons with a cross section which is not less than that for charged mesons.

Photo-meson production is among the simplest of phenomena involving mesons; and it might therefore be hoped that some of its general features can be understood on the basis of our admittedly very incomplete theoretical knowledge of the properties of mesons. In particular, we are interested in seeing whether a photoproduction cross section for neutral mesons as large as that for charged mesons can be understood theoretically.

For the photoproduction of charged mesons Brueckner found that of the four types of meson fields only the pseudoscalar theory gave satisfactory agreement with experiment. For such a theory as the scalar theory with charged meson currents extending about the nucleon over a region of the order of the meson Compton wavelength, the angular (dipole) distribution of the ejected photomesons arising from the coupling of the electromagnetic field to the meson currents is incompatible with the observed, flat angular distribution for charged mesons. Such a coupling of the charged meson field to the electromagnetic field would also lead one to expect the ratio of cross sections for neutral to charged mesons to be of the order of $(\mu/M)^2$ (where μ is the meson mass and M is the nucleon mass), since the neutral meson production the electromagnetic field coupling is to the nucleon. This is in contradiction to the observed largeness of the neutral meson cross section.

Assuming that neutral meson production takes place through the interaction of the electromagnetic field with the magnetic moment of the nucleon, both classical and lowest order perturbation calculations for scalar mesons and pseudoscalar mesons with pseudovector coupling lead to a ratio of the neutral to charged meson cross section (near threshold) of the order of $(\mu/M)^2$, in agreement with the foregoing qualitative arguments.

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Such semiclassical arguments are not necessarily applicable in the case of the pseudoscalar field, however, where relativistic quantum-mechanical effects are likely to be important. Here the matrix element for neutral meson production for a γ-ray striking a proton is proportional to

$$(F \mid H \mid I) \simeq \underline{\mu} \cdot \underline{\xi}(\rho) \left\{ \left[\frac{1}{P_I \cdot \rho} - \frac{1}{P_F \cdot \rho} \right] M_{p_0} \right\} \quad (1)$$

$\underline{\mu}$ is the Dirac magnetic moment of the proton, P_I and P_F are its four-momenta in the initial and final states, respectively, ρ is the four-momentum of the incident protons, and $\underline{\xi}$ is the electric field strength. Equation 1 differs from that for charged meson emission by the factor in brackets, which is nonvanishing only because of retardation effects and is of order (μ/M) near threshold. This is because the magnetic moment is relatively undisturbed by the process of neutral meson emission, causing phase cancellation between initial and final states. Thus, again the ratio of neutral to charged meson sections is of order $(\mu/M)^2$. Similar results are obtained for vector and pseudovector theories. (The experimental evidence is against the neutral mesons having spin 1, because of their apparent annihilation into two photons (C. N. Yang, Phys. Rev. 77, 242(1950).)

It is seen, therefore, that neither classical considerations nor lowest order perturbation theory provide a clue to the largeness of the cross section for neutral photomesons. We note, however, that the factor in the brackets in Eq. 1 is small only when the nucleon recoil is small. Because of the very close binding of the meson field to the nucleon for pseudoscalar theory, high energy virtual recoils are expected and it might be thought that these will remove the near cancellation of the two terms in the brackets. To investigate this possibility, we have calculated the first order radiative corrections to Eq. 1. The corresponding radiative corrections for charged meson production have been calculated by Brueckner. Combining lowest order and first order radiative corrections for both charged and neutral meson production and choosing the coupling constant as $g^2/4\pi \simeq 10$ (a reasonable value obtained from other considerations), we obtain about equal cross sections for the two processes—in reasonable agreement with experiment. With this choice of coupling constant, the radiative corrections to charged meson production are not qualitatively important, while for neutral meson production the lowest order terms are small.

Since the validity of large radiative corrections is open to considerable doubt, we feel justified in concluding only that the large observed cross section for neutral meson production is not necessarily incompatible with conclusions that can be drawn from pseudoscalar meson theory.

4912 A Measurement of the Positive π-μ Decay Lifetime. O. Chamberlain, R. F. Mozley, J. Steinberger, and C. Wiegand. UCRL-700, May 10, 1950. 8p.

In the experiment reported here the time lag between the two bursts of fluorescence due to mesons decaying in a scintillation crystal is observed. The first burst is due to the stopping of the entering π meson, the second to the μ meson. The mean lives obtained are $2.65 \pm .12 \times 10^{-6}$ sec (differential data) and $2.65 \pm 0.8 \times 10^{-6}$ sec (integral data). The discrepancies between these values and previously reported measurements are not understood.

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4913 Atmospheric Effects on Cosmic Radiation, Air-mass Absorption, and Meson Decay. F. Lindholm. Tellus 2, 63-7(1950) Feb.

The percentage variations of 24 means of cosmic radiation in Stockholm (magnetic latitude 58°) amount to ±5% of the mean value over a quiet period of two month's duration. The two atmospheric effects, the mass absorption due to ionization and the meson decay, contribute ±4%. The residual variations, in excess of statistical fluctuations of 0.1%, depend upon other factors, such as geomagnetic activity and solar influences. The true absorption coefficient for zenith radiation (β) is calculated to have a value of 1.27 10^{-3} cm^2/g and the rate of decay (β') is found to be about 0.060/km. The meson-producing layer is attributed to the 200-mb surface, the highest level reached by the daily radiosonde ascents in Stockholm. The most reliable decay value is obtained by considerations of the thermal structure of air-mass changes in traveling deep depressions of atmospheric pressure. (auth)

4914 Correlation of Geomagnetic Cosmic-Ray Effects. H. V. Neher. Phys. Rev. 78, 674-80(1950). June 15.

With the experimental data collected in a B-29 airplane and given in an earlier report (Phys. Rev. 76, 914(1949)), an attempt is here made to correlate several of the well-known geomagnetic effects found in cosmic rays. First, evidence is presented to show that, within the uncertainties of the experimental data and the existing calculations on the behavior of charged particles in the magnetic field of the earth, there are few if any negative primary particles in the momentum range 7 to 23 Bev/Zc compared with positives. Second, under the assumption of angles with the zenith angle effect in the east-west plane at the equator, it is possible, with the help of calculations of Vallarta to determine curves of minimum momentum for the primaries as a function of geomagnetic latitude. It is thus possible to plot curves for intermediate latitudes where the calculations are extremely difficult and have not been carried through in detail except in certain special cases. The results are independent of any assumed momentum distribution of, or the magnitude of charge carried by the primary particles. (auth)

4915 Cosmic Radiation and Radio Stars. H. Alfvén and N. Herlofson. Phys. Rev. 78, 616(1950) June 1. (Letter to the editor).

The authors indicate several reasons for believing that the "stellar" radio waves actually originate in regions much larger than stars. According to a recent development of Teller and Richtmyer's theory of cosmic radiation, the sun should be surrounded by a "trapping field" of the order 10^{-6} to 10^{-5} gauss which confines the cosmic rays to a region with dimensions of about 10^{17} cm (0.1 light year). It is assumed that other stars are also surrounded by cosmic rays trapped in a region of similar dimensions and that the radio star emission is produced by trapped cosmic ray electrons. The emission of radio waves by such particles is analyzed, and the author shows that, in order to account for the total energy emitted by a radio star, it must be supposed that the radio emission is a transitory phenomenon, lasting a time which is short compared to the life time of cosmic rays in the trapping field, or that the cosmic ray acceleration close to the star is supplemented by a Fermi process (Phys. Rev. 75, 1169(1949)) further out in the trapping field. It is also concluded that a radio star must emit very little light and should be situated in an interstellar cloud.

4916 Cosmic Rays. Part II. Mesons. W. O. Lock and H. Muirhead. Weather 5, 172-5(1950) May.

This is a brief sketch of developments in cosmic-ray studies since the Anderson and Neddermeyer photograph of a meson track in 1938. Four typical events in nuclear emulsions are illustrated.

4917 Decay and Nuclear Interactions of Stopped Charged Mesons. G. B. Zhdanov. Uspekhi Fiz. Nauk 39, 512-72(1949) Dec. (in Russian).

A review is made of studies of the decay and the nuclear captures of stopped charged mesons. 131 references, of which 39 are Russian.

4918 Disintegration of Nuclei by π^- Mesons. W. B. Cheston and L. J. B. Goldfarb. Phys. Rev. 78, 683-5 (1950) June 15.

Investigations of nuclear disintegrations induced by π^--meson absorption in nuclear emulsions, exposed to the π^--meson beam of the 130-in. Rochester cyclotron, have been carried out. The energy spectrum of the protons emitted from the absorptions shows two distinct processes occurring: (a) evaporation of nucleons from an excited nucleus and (b) emission of knock-on protons, brought about by the interaction of a π^- meson with a multiparticle structure in the nucleus. Of the mesons ending in the emulsion, 10 ± 2% give rise to protons with energies ≥ 30 Mev. Strong evidence is presented for the boson character of the π^- meson. (auth)

4919 Energy Transfer to Nucleons in Cosmic-Ray Stars at 95,000 Feet. H. L. Bradt and M. F. Kaplon. Phys. Rev. 78, 680-2(1950) June 15.

The size-frequency distribution of cosmic-ray stars produced in photographic emulsions exposed at 95,000 ft altitude and the energies associated with the nonrelativistic prongs of these stars have been determined. A distribution function for the excitation energy of stars with more than 8 prongs is derived. (auth)

4920 Extensive Showers; Penetrating, Soft Particles, and Photons; Barometric Influence. J. Clay. Physica 16, 278-92(1950) Mar.

The proportion of penetrating to soft particles which is found in showers depends on the dimensions and geometrical arrangement of the counters used for shower detection. The influence of lead layers above and between the counters was measured and then the amount of photons in the showers was calculated. It is shown how the increase in photons due to the interposition of lead increases the number of coincidences, and therefore shower frequency for a given cosmic ray density. The influence of barometric pressure was found to be 14% cm^{-1} Hg. The author arrives at the conclusion that the showers are produced by protons in the higher atmosphere.

4921 A Hodoscope Study of Penetrating Cosmic-Ray Showers. II. Extensive Showers. Kurt Sitte. Phys. Rev. 78, 721-6(1950) June 15. (See also NSA 4-4618.)

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The interactions of penetrating particles in air showers have been studied with a hodoscope arrangement at an altitude of 3260 m. About 90% of all charged penetrating particles do not originate local showers of penetrating secondaries, and are absorbed only very slowly. This "noninteracting component," consisting at least predominantly of μ mesons, has a rather flat range spectrum between 280 and 680 g/cm^2 Pb. Its zenith angle distribution is approximately proportional to $\cos^4 \theta$. The remaining 10% constitutes a "charged N component"; the total fast N component amounts to about ¼ of the number of the charged penetrating particles. The collision mean free path of the fast N component was found to be (220 ± 30) g/cm^2 if a minimum of 100 g/cm^2 penetration is demanded for the local showers. From the recorded increase of the number of shower particles with absorber thickness it is concluded that further multiplication after the first collision is quite common, and that the mean free path of the secondaries of local showers is not much larger than that of the primary N component. (auth)

4922 Masses of the π- and μ-Mesons. Ira M. Freeman. Nature 165, 933(1950) June 10 (Letter to the editor).

In an attempt to relate meson masses with fundamental constants and properties of space, attention is invited to the constant $hc/2\pi e^2 = 137$ and the possibility of a quantum of meson mass $\Delta m = m_\pi - m_\mu = 137/2$ electron masses. Taking 276 and 210 as the best experimental values of m_π and m_μ, it is noted that $m_\pi \, m_\mu = \pi (137)^2$, approximately. A combination of this with Δm would place the masses at $m_\pi = 279.5$ and $m_\mu = 211.0$ electron masses. The lightest meson would have a mass $211.0 - 3\,\Delta m = 5.5$.

4923 On the Lateral Distribution of an Extensive Swarm of Particles of Cosmic Rays in Air. C. Milone, S. Tamburino, and G. Villari. Nuovo cimento 7, 207-19(1950) May 7 (in Italian).

Measurements with G-M counters have been made at Catania (elevation 35 m) in order to study the lateral distribution of penetrating particles in extensive cosmic-ray air showers and the distribution compared with that of the electrons. The following results have been obtained: (1) The ratio of penetrating particles to electrons is about 3% in the central side of the shower, and seems not to change when the mean density in this side varies from 35 to 105 m^{-2}. (2) Selecting showers which have in the central side a mean density of 35 particles m^{-2}, it has been found that the ratio,

$$\frac{R_p}{R_e} = \frac{\text{Density of penetrating particles at distance r from the "shower axis"}}{\text{Density of electrons at distance r from the "shower axis"}},$$

increases slowly with r but changes only by a factor 1.6 between r = 0 and r = 50 m. (auth)

4924 On the Measurement of the Mass of Cosmic Ray Particles Using a Sandwich of Photographic Plates in a Magnetic Field. Y. Goldschmidt-Clermont and M. Merlin. Nuovo cimento. 7, 220-9(1950) May 7.

Sandwiches of photographic plates with emulsions facing each other at a distance of 1.5 mm, were exposed in a magnetic field of 30,000 gauss at sea level. The relative position of the plates was determined by a grid of the marks produced by a thin pencil of x-rays. During the preparation, exposure, and processing the greatest care was taken to insure to the plates maximum sensitivity, and to avoid distortion of the gelatin. The radius of curvature of the track in the magnetic field, during the flight between the emulsions, is determined from the relative direction and position of the tangents at the impact points in the emulsions. When the particle ends in one of the emulsions, this measurement of momentum can be combined with a measurement of range, to calculate the mass as stated by Powell and Rosenblum (Nature 161, 473(1948)). When the particle passes through the two emulsions, the measurement of momentum can be combined with a measurement of grain density, in the region of energies where this parameter is sufficiently sensitive, or with a measurement of scattering, when the length of track available for measurement is sufficient. (auth)

4925 On the Nucleonic Components of Cosmic Radiation at the Average Energy. P. Budini and N. Dallaporta. Nuovo cimento 7, 230-54(1950) May 7 (in Italian).

The development of the nucleonic component of cosmic rays in air is discussed. It is assumed that it is generated by, and still partly composed of, the primary nucleons which interact with the nucleons of the air, and that the differential cross section both for the energy loss of nucleons and for the expulsion of the secondary nucleons from the air nuclei, is of the bremsstrahlung type. Account is taken of the energy loss caused by slowing down in nuclear matter, and for energy loss caused by ionization produced by nucleons which are in proton state. Taking into account this loss of energy and the probability that a nucleon has traveled a certain part of its path as a proton and the rest as a neutron, a calculation is made to ascertain the ratio of proton and neutron components. The limits of validity of the method are discussed and the results are compared with the experimental data. (auth)

4926 On the Origin of the Cosmic Radiation from the Sun. K. O. Kiepenheuer. Phys. Rev. 78, 809-10(1950) June 15 (Letter to the editor).

Suggested mechanisms to account for the cosmic radiation component, of about 1 particle/cm^2 sec, following certain solar flares are criticized, and a new picture is proposed of a beam of heavy ions accompanied by a shielding sheath of protons and electrons. The origin of fields and currents necessary to produce such a beam is suggested.

4927 On Positive and Negative Excess of the Penetrating Component of Cosmic Radiation at 3500 m above Sea Level. I. F. Quercia, B. Rispoli, and S. Scinti. Nuovo cimento 7, 277-80(1950) May 7.

A similar article by the same authors has been published in Phys. Rev. 78, 824-5(1950) June 15. An abstract of this article has been listed in NSA as abstract 4-4623.

4928 On the Primary Cosmic-Ray Spectrum. J. A. Van Allen and S. F. Singer. Phys. Rev. 78, 819(1950) June 15 (Letter to the editor).

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In high altitude rocket experiments the following cosmic ray intensities above the atmosphere were obtained:

Geomagnetic latitude λ	Experimental vertical intensity j(0°)	Geomagnetic cut-off momentum/charge ratio pc/Ze
0°	0.028 ± 0.004/sec cm² steradian	15.0 Bev
41°N	0.073 ± 0.006	4.8
51°N	0.18 ± 0.02	2.6
58°N	0.29 ± 0.03	1.2

By comparing the intensities, measured directly by the authors, with those deduced from the atmospheric ionization integrals, it is seen that the former are markedly higher at all latitudes. In the range 2.6 Bev to 15 Bev the integral number spectrum can best be fitted by $N(>pc/Ze) = 0.48\ (pc/Ze)^{-1.1}$ (sec cm² steradian)$^{-1}$, corresponding to a differential number spectrum $dN = 0.53(pc/Ze)^{-2.1}d(pc/Ze)$. This spectrum is considerably flatter than that hitherto deduced from ionization measurements. A marked flattening of the form of the spectrum appears to occur for rigidities below 1.5 Bev (λ = 56°).

4929 On the Problem of the Generation of Mesons and the Effect of Latitude. M. Ferretti Sforzini. Nuovo cimento 7, 196-206(1950) May 7 (in Italian).

The number Λ(W,λ,E) of mesons which arrive, at sea level from all possible directions, and which have been generated with an energy E by a nucleon of energy W at a latitude λ, has been calculated. Using this number, which is independent of any particular hypothesis of mesons production, the total intensity of meson radiation at sea level has been calculated as a function of the latitude, using the Wataghin hypothesis of production. Experimental results are compared with the results of calculation. (auth)

4930 On the Production of Nuclear Mesons by Photons (Meson of Spin 0). Pierrette Benoist-Gueutal, Jacques Pretki, and Jean Ratier. Compt. rend. 230, 1146-8(1950) Mar.

Previous studies of the production of π mesons in photon-nucleon collisions have not included the effect of the recoil of the nucleon, and do not permit an interpretation of the observed excess of negative over positive mesons. The authors have treated the problem relativistically and quantum-mechanically, using the Born approximation, and assuming scalar and pseudoscalar meson fields. The calculation was based on Feynman's perturbation method; matrix elements for the process were obtained by limiting the calculation to the second order and neglecting radiative corrections. Matrix elements are given for the production of mesons with a given energy by nonpolarized photons of given momentum. The spectrum for pseudoscalar mesons is in good agreement with the spectrum of the mesons produced by photons at Berkeley.

4931 Particles Angularly Associated in Penetrating Showers. M. G. E. Cosyns. Bull. centre phys. nucl. univ. libre Brux. 1950, No. 18, May. 5p. (in French).

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Twelve penetrating showers were observed in photographic plate exposed at Pic du Midi at an altitude of 2990 m. This article attempts to obtain angular relationships between the particles in the showers.

4932 Penetrating Showers at High Altitude. M. G. Nooh and S. R. Haddara. Proc. Phys. Soc. (London) 63, 606-16(1950) June 1.

A study has been made of cloud chamber photographs of penetrating cosmic-ray showers, originating in lead placed over the cloud chamber and in a lead plate within the cloud chamber, obtained at altitude 3572 m in a magnetic field of about 1000 gauss. The use of well separated successive lead layers allowed the association of penetrating events to be demonstrated, and there is some evidence of a general reduction of energy involved in events in the lower lead layers as compared with those in the top layer. Mesons, protons, and particles of higher charge were identified in the penetrating showers, and a mean range for noncoulomb scattering of shower particles is given. Evidence is also given of the apparent starting and stopping of charged particles in the lead plate at the center of the cloud chamber. (auth)

4933 Several Properties of Rossi Showers Under Thick Dense Shields. Andre Freon. Compt. rend. 230, 2178-80(1950) June 19 (in French).

Cosmic ray measurements at sea level were made with the counters placed under various thicknesses of lead and under 30 m of earth to obtain an insight into the nature of Rossi showers. It is concluded that the electron showers originate from the last few millimeters of lead traversed by the meson and are mainly due to collisions rather than the disintegration of the meson.

4934 Stars and Heavy Primaries Recorded During a V-2 Rocket Flight. Herman Yagoda, Hervasio G. de Carvalho, and Nathan Kaplan. Phys. Rev. 78, 765-7 (1950) June 15.

Plates flown to an altitude of 150.7 km in a V-2 rocket exhibit a differential star population of 5000 ± 800/cc/day and a flux of heavy primaries of about 0.03/cm²/min above the stratosphere. The star intensity is about 3.6 times greater than that recorded by plates exposed in the stratosphere, the increment being attributable to secondary star-forming radiations created by interaction of cosmic-ray primaries with the massive projectile. The flux of heavy primaries is essentially of the same order of magnitude as reported for elevations of 28 km. (auth)

4935 The Zenith Distribution of Penetrating Particles of Cosmic Rays Included in a Band of Weak Energies. Anatole Rogozinski and Andre Voisin. Compt. rend. 230, 2092-4(1950) June 12 (in French).

Cosmic ray measurements were made at altitudes of 148 m and 2870 m for zenith angles, θ, from 0 to 73 deg using a method described in a previous article (Compt. rend 227, 1092(1948)). The distribution of particles obeys the empirical law $1 - a \sin^b \theta$, where $a \simeq 1$ and $b \simeq 1.4$. At large zenith angles, θ, the distribution is more isotropic than the law for the zenith distribution of the integral spectrum predicts. Preliminary measurements seem to indicate the existence

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of penetrating particles at $\theta > 90$ deg, probably arising from nuclear explosions. (auth)

4936 VX-32 Current Integrator. Clarence J. Brown. LA-1059, July 7, 1949. 17p.

A current integrator is described which is capable of an accuracy of 1.5% with an input of 0.005 to 0.1 ma. The measurement of current by the method of charging a condenser presents difficulties if the current is very small, since the magnitude of the leakage currents is of the same order as the current that is to be measured. The instrument described attempts to avoid this difficulty by the use of extremely low-leakage condensers, and an electrometer-tube technique to measure the voltage change across the condenser. By this means, the leakage current is reduced to a very small fraction of the current to be measured, even though this current is of the order of 10^{-9} amp.

4937 The Application of the Cathode Ray Tube to Microphotometry of Trace Elements. H. M. Davis and R. J. Webb. Spectrochim. Acta 4, No. 1, 13-20 (1950).

The apparatus described is designed as an accessory to a nonrecording microphotometer for the purpose of presenting a picture of the blackening contour of a portion of a spectrogram on the screen of a cathode ray tube. Low-frequency scanning is obtained by means of a cam which simultaneously reciprocates the plate carrier over the microphotometer slit and reciprocates a potentiometer slider to vary the sweep voltage of the tube. Although of general application, its principal function is the detection and estimation of trace elements in complex spectra, when normal nonrecording microphotometry and visual methods are difficult or impracticable. A method for the quantitative interpretation of the contours and particular implications of this aspect of microphotometry are discussed. (auth)

4938 A Cartographic Microscope. M. Cosyns and G. Vanderhaeghe. Bull. centre phys. nucl. univ. libre Brux. 1950, No. 12, Jan. 4p. (in French).

A description is given of the design of a microscope which permits continuous tracing on a magnified scale of tracks in a nuclear emulsion. This apparatus cuts down on fatigue and gives increased accuracy and speed.

4939 LKB Products, Instrument Company, of Stockholm, Sweden. M. E. Bell. Office of Naval Research (London Branch) Technical Report No. OANAR-5-50, Jan. 12, 1950. 4p.

A description is given of a small but important manufacturer of scientific instruments in Sweden. The sales and service methods are discussed, and are concluded to be advantageous over the usual practice. Some of the more important pieces of equipment which are described are an 90-in. fm cyclotron for Uppsala University, electrophoresis apparatus, centrifuges, absorption chromatography equipment, galvanometers, etc.

4940 Physical Problems in High-Intensity Ion Sources. C. J. Bakker and J. Kistemaker. Helv. Phys. Acta 23, Supp. 3, 46-50(1950).

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The characteristics of high intensity ion sources are discussed with respect to the following problems. (1) the production of ions in the discharge; (2) the transportation of the positive ions to the edge of the plasma, or out of the discharge in the direction of the exit opening; and (3) the extraction of the ions from the source without disturbing the discharge.

4941 Radiofrequency Ion Sources. A. G. Ward. Helv. Phys. Acta 23, 27-38(1950).

The published data on radiofrequency ion sources are reviewed. Various sources are compared, and the factors influencing their design and performance are discussed. The factors governing the production of beams containing a high percentage of protons are considered in some detail, as well as the extraction of positive ion beams.

4942 X-Ray Tube Producing a Beam of X-rays Convergent to a Point. C. H. Bachman and S. J. Silverman. J. Applied Phys. 21, 615(1950) June (Letter to the editor).

A brief, preliminary note is made of an x-ray tube having a filament lying along the axis of a truncated conical target. An annular collimator selects a hollow cone of x-rays leaving the small end of the target, which cone then converges at its apex and diverges again beyond.

4943 The Distribution of S^{34} in Nature and the Sulfur Cycle. A. Szabo, A. Tudge, J. Macnamara, and H. G. Thode. Science 111, 464-5(1950) Apr. 28.

Studies conducted to determine the distribution of S^{34} in nature showed that sulfates in general are enriched with the heavy isotopes of sulfur, as contrasted with hydrogen sulfide and other sources of sulfur. The results suggested to the authors that sea water sulfate, the source of many sulfate deposits, might also be enriched and that the large reservoir of sulfur in the sea might provide a base level from which the isotopic content of other sulfur sources might be reckoned. In consequence of this assumption, experiments were performed which indicated that the sea water sulfates are enriched in the heavy sulfur isotopes and that the isotopic ratios are relatively constant for three different oceans. Previous experiments had shown that when sulfate and hydrogen sulfide were present in ground water samples, the S^{34} content of the sulfate was much greater; this may be explained on the basis of isotopic fractionation in the conversion of sulfate to hydrogen sulfide in nature. Sulfur samples from cystine, obtained from human hair, were also investigated and it was found that the heavy isotopic value fell between the values for sulfate and hydrogen sulfide. Other experiments are in progress.

4944 Superconductivity of Isotopes of Mercury. B. Serin, C. A. Reynolds, and L. B. Nesbitt. Phys. Rev. 78, 813-14(1950) June 15 (Letter to the editor). (See also NSA 4-4001.)

The transition temperatures (T_o) were obtained for mercury, enriched in its various isotopes, from variations of the magnetic critical fields with temperature. T_o changed from 4.137 to 4.167°K as the average mass number M was varied from 203.4 to 199.7. The product $M^{1/2}T_o$ remained almost constant at ~58.9.

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4945 Closely-regulating Needle Valves for Ion Sources. Heinz Ewald. Z. Naturforsch. 5a, 230-1(1950) Apr. (Brief note, in German).

Ion sources used in nuclear physics should be as constant and reproducible as possible. If gaseous material is used as source of the ions, it is necessary to produce very small and constant gas streams. A needle valve is described here which will meet the most exacting requirement. Its construction is illustrated by means of a detailed diagram.

4946 The Development of a Magnetic Ion-Source with High Ionization Efficiency. P. C. Veenstra and J. M. W. Milatz. Helv. Phys. Acta 23, Supp. 3, 39-45(1950).

The construction and operation of a magnetic ion source are described. This source is characterized by low power consumption and low gas pressure. High currents of monokinetic ions are obtained, with up to 50% atomic ions in the beam. No artificial cooling is required.

4947 Effects of Initial Energies on Mass Spectra. Clifford E. Berry. Phys. Rev. 78, 597-604(1950) June 1.

The slit system of a conventional mass spectrometer discriminates against ions having initial kinetic energies. Relations between the amount of the discrimination and the geometry of the system are developed and confirmed experimentally for ions having only thermal energy. Curves showing the discrimination against high energy fragments from a number of simple molecules are given. These curves show that measured relative abundances depend strongly on the geometry of the system and on the accelerating voltage. In theory, the initial velocity distribution can be obtained from discrimination data. This method is shown to be impractical, and a better method is described, which involves electrostatic deflection of the ion beam in a direction parallel to the magnetic field. Curves of ion intensity vs deflecting potential give directly the shape of the distribution for one component of initial velocity. Distribution curves are given for the same ions for which discrimination curves were obtained.

4948 Mass Spectra of Diborane-d_6 and Ethane-d_6. Vernon H. Dibeler, Fred L. Mohler, and Laura Williamson. J. Research Natl. Bur. Standards 44, 489-94(1950) May.

The complete mass spectra of B_2D_6 and C_2D_6 and the partial spectrum of B_2D_5H have been obtained for ionizing voltages of 50 and 70 v. An analytical procedure is given for deriving the contribution of all ions containing a hydrogen atom from the polyisotopic spectrum of a mixture of B_2D_6 and B_2D_5H. A comparison of spectra of B_2D_6 and B_2H_6 and of C_2D_6 and C_2H_6 indicates that substitution of deuterium for hydrogen has only a slight effect on the dissociation probabilities in diborane and ethane. An exception is the occurrence of a metastable transition in B_2D_6 that does not occur in B_2H_6 viz. $B_2D_5^+ \rightarrow B_2D_3^+ + 2D$. Simple statistical considerations, based upon the assumption of equal probabilities for the removal of a deuterium or a protium, give a dissociation pattern that differs by more than experimental error from that observed. (auth)

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4949 Modification of the Monte Carlo Method. H. Kahn. Rand Corporation Report No. P-132(RAND), Nov. 14, 1959. 21p.

This report is a revised version of a talk given at the Seminar on Scientific Computation at Endicott, New York, on November 14, 1949. It discusses the problems of evaluating integrals and solving integral equations by random sampling, with particular emphasis on the techniques available to the computer that will reduce the size of the sample required. (auth)

4950 Neutron Capture Gamma-ray Spectra. Bernard Hamermesh. ANL-4447, May 1, 1950. 26p.

Photographic plates soaked in D_2O may be used for γ-ray studies. By measuring the ranges of the photoprotons resulting from the photodisintegration of the deuterons in the D_2O the γ-ray energies may be found. The method is limited to γ rays of energy above 3 Mev. The neutron capture γ-ray spectra of Al, Cl, Fe, Br, Cd, La, W, Au, and Hg have been obtained by this method. The results suggest a possible dependence of the shape of the spectra on the odd-even character of the compound nucleus. 10 references. (auth)

4951 Beta Film Monitoring Procedure. Hilda Bass. NYO-1512, Apr. 3, 1950. 15p.

It is the purpose of this work to re-examine the β-film monitoring procedure of the NYOO Health and Safety Division to determine the validity of the procedure. In the current procedure it is assumed that film darkening is directly proportional to β exposure. Based on this assumption, it is general practice to measure the β dose by subtracting the density due to γ exposure from the β plus γ density read on the open window portion of the film, using the difference to read off the dose on the β calibration curve. Dental film packets were exposed to β radiation, from uranium metal in contact, for known periods of time ranging from 1 to 16 hr. The plot of density versus β exposure was found not to be a straight line. This is especially in evidence in the region above 900 mrep. An experiment was devised to determine the error involved in treating film darkening as a linear function of β exposure. Film was exposed to known amounts of γ radiation from radium: 0 mr, 100 mr, 300 mr, 1000 mr. Film from each of these groups was then exposed to β radiation (0 to 3840 mrep). The β dose was then estimated by two methods: (1) assuming linearity, and (2) employing the true curve of β darkening vs exposure. It was found that in film exposed to a large quantity of γ radiation the difference in the two methods of determining β exposure is large especially when the β exposure is greater than 900 mrep. In less dense films the difference in the two methods is not quite so marked. It is recommended that for film exposed to a relatively large quantity of radiation (equivalent to a density of 0.5 or above) the revised procedure be used in determining β dosage. (auth)

4952 Development of Boron Lined Neutron Counter Tubes. E. P. Kozoriz, H. W. Bousman, A. A. Batza, and J. Palm. NYO-1519, July 13, 1949. 55p.

The fabrication of, and tests which were performed on, boron-lined proportional neutron counter tubes are described in detail. The samples used consisted of tubes lined with normal boron and boron enriched in B^{10}. The design of the

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tube lends itself to mass production and facilitates filling and sealing off procedures. Satisfactory performance was noted using a mixture of anhydrous ethyl ether and argon at a total pressure of 25 cm. An expression for the theoretical efficiency was derived. The theoretical efficiency will be at its maximum when the thickness of the boron film is equal to the range of the transmutation particles in boron. With the equation established, E_{max} was found to be equal to 1.6%. Previous investigators had given a much higher figure. A method for the determination of the thickness of thin boron films using an indium foil technique has been found. (auth)

4953 Anomalies Observed in the Range-Speed Relation for α Particles in Photographic Emulsions. Leopold Vigneron and Maarten Bogaardt. Compt. rend. 230, 2176-8(1950) June 19 (in French).

The authors plotted experimental points for the range energy relation for α particles and protons in a silver bromide emulsion. Results show that for speeds below 1.2×10^9 cm/sec, the α particle loses energy 4 times as fast as protons of the same speed. However, theoretical range-energy equations show that protons begin to capture electrons at higher speeds than the α particles. This apparent anomaly does not exist in air where theoretical calculations and experiments are in good agreement.

4954 Application of Proportional Scintillation γ-ray Counters to the Determination of Radioactive Decay Schemes. Patrick E. Cavanagh. Nature 165, 889-90(1950) June 3 (Letter to the editor).

Organic crystal scintillation counters were used as a simple but highly efficient γ-ray spectrometer and applied to the determination of the decay scheme of I^{131}, in particular the maximum energy of the lower-energy β group in coincidence with the 640-kev γ rays, which was found to be 315 kev.

4955 The Calibration of Proportional Counters with X-rays Produced by Radioactive Sources. P. Rothwell and D. West. Proc. Phys. Soc. (London) 63A, 541-3(1950) May 1 (Letter to the editor).

The size and cost of x-ray tubes often preclude their use as sources for the calibration of proportional counters. In such cases, two types of radioactive sources may be used conveniently: long-lived radioactive isotopes which decay by K-capture, and thin foils bombarded with α particles. A systematic investigation of these alternative sources has been carried out and is reported in this article. K-capture sources were prepared by irradiation with thermal neutrons in the Harwell pile, and the x-ray spectra for several such sources is described in detail. The authors also discuss the x-ray spectrum produced by the bombardment of a nickel foil with α particles from 1 mc of Po. This spectrum has a peak at 7.5 kev. The intensity is sufficient for calibration purposes and the distribution is comparatively free from background. The production of x-rays by bombardment with β-particles was also tried but, except in the case of low energy x-rays, the results were unsatisfactory due to the presence of the continuous x-ray spectrum.

4956 The Crystal Counter. J. M. W. Milatz and H. A. Van der Velden. Helv. Phys. Acta 23, 89-94(1950).

Crystal counters are described, whose mode of operation is as follows. The electrons of the ion pairs formed in the crystal under the influence of α, β, or γ particles move through the conduction band of the crystal, so that a charge is induced on the electrode of the ionization chamber just as in the case of a gas-filled chamber. One of the advantages of the crystal counter is the possibility of measuring the energy of the particle being detected, since the pulse size depends on the particle energy. A rather troublesome disadvantage is the polarization to which the crystal counter is subject. This polarization beomes detectable as an appreciable decrease of the pulse size and the number of pulses, when the crystal is irradiated for a long time. This effect is due to the slow accumulation of trapped charges which give an electric field opposite in sign to the applied one. To overcome polarization effects, one can periodically reverse the applied field, heat the crystal after a certain amount of irradiation, or expose the crystal to infrared and red light during irradiation.

4957 The Crystal Counter Method for the Measurement of γ-ray Energies. D. Maeder. Helv. Phys. Acta 23, 95-6(1950).

Investigations of crystal counters were carried out which employed AgCl crystals that were exposed to the Th(B + C)- and Li(p,γ)-radiations. With the latter radiation the pulse amplitude distribution showed a pronounced peak at about 6 times the maximum amplitude of the 2.6-Mev measurements. Apart from demonstrating the possibility of estimating unknown γ-ray energies, this result confirms the proportionality between electron energy and pulse amplitude over a wide energy range. The accuracy was limited, however, by the relatively high noise level of the apparatus used for these preliminary experiments.

4958 The Detection of Alpha Rays by Single Crystals of Thallium Activated Sodium Iodide. E. G. Michaelis. Helv. Phys. Acta 23, 154-60(1950).

An investigation was carried out to find phosphors for scintillation counting which respond efficiently to alpha rays or heavier particles, and which are available in large transparent crystals. Single crystals of sodium iodide were activated with 1% thallium iodide, cleaved to obtain specimens 1 to 2 mm thick, and bombarded with alpha particles from a polonium source. For comparison, silver-activated zinc sulfide was also irradiated by alpha particles from the same source. The pulse size distribution for zinc sulfide was approximately uniform, as is often the case with microcrystalline phosphors. For sodium iodide an approximately Gaussian distribution was obtained which is characteristic of single crystal scintillators. Using Kallmann's value (Research 2, 64(1949) and Z. Naturf. 4a, 204(1949)) of 28% for the efficiency of light production by silver-activated zinc sulfide under alpha-particle bombardment, the author finds sodium iodide to be 6% efficient.

4959 Determination of Energy of Single Alpha Particles from Change in Conductivity of Cadmium Sulfide Crystals. H. Kallmann and R. Warminsky. Research 2, 389-92(1949) Aug. (See also NSA 3-828.)

In continuation of previous work on the conductivity of cadmium sulfide crystals (Ann. Physik 4, 69(1948)), the behavior of very weakly activated crystals excited by single alpha particles is investigated in detail. It is found that the pulses of current in these crystals are proportional to the energy of the absorbed particles. This property, as well as

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the short decay period of the pulses, makes the crystals suitable for quantitative measurements. Such crystals have a number of advantages over an ionization chamber; in particular, the whole arrangement is considerably simpler. (auth)

4960 Distortion of Nuclear Emulsions. M. Cosyns and G. Vanderhaeghe. Bull. centre phys. nucl. univ. libre Brux. 1950, No. 15, Feb. 4p. (in French).

The development of nuclear emulsions results in a distortion of the emulsion which limits the accuracy of the experiment. This article defines the "coefficient of distortion," from which the curvature caused by the distortion can be calculated.

4961 Effect of the Density and Average Atomic Number of the Medium on the Counting Yield of Beta and Gamma Radiation in a Solution-Type Geiger Counter. Robert Sieh-Hsuan Chiang and John E. Willard. University of Wisconsin, nd. 10p. (AEC File No. NP-1339.)

In investigations which employ radioactive tracers it is frequently desirable to determine the quantities of different chemical species which contain the tracer by counting them in a solution-type Geiger tube. Often these species are most conveniently introduced into the solution chamber of the tube in mediums which have different densities and different average atomic numbers, or both. In order to obtain a better understanding of the factors which control the counting yield in solution, the effect of increasing density and average atomic number of the solvent on the counting efficiency of the radiations from the following four sources, P^{32}, Ce^{144}-Pr^{144}, Br^{82}, and Co^{60}, has been determined. The data indicate that (dependent upon the radioactive species) the specific counting rate may either decrease or increase when the density of the solvent is increased and the rate of decrease or increase is dependent on the atomic number of the elements in the salts which are used to increase the density.

4962 An Electrometer with Mechanical Conversion. F. A. Muller. Helv. Phys. Acta 23, 88(1950).

A short description is given of a recently developed converting vacuum tube electrometer. The principal part of such an instrument is a vibrating condenser which converts d-c charges into a-c voltages.

4963 An Electron-Beam Decimal-Counter Tube. D. L. Hollway. Nature 165, 856-7(1950) May 27 (Letter to the editor).

An electron tube is described in which the beam is caused, by successive input pulses, to pass in turn through 10 number cut-outs and thus to display the appropriate count on the fluorescent end of the tube. The beam remains stable at one number until an input signal causes it to move radially to a collector segment so connected to a set of deflector segments that the potentials of the latter are altered. The beam is thereby deflected to the succeeding stable position and 10 input signals thus produce a complete rotation.

4964 Experimental Determination of the Range-Energy Relation and Stopping Power of Nuclear Emulsions for Charged Particles of Low Energy. Henriette Faraggi. Compt. rend. 230, 1398-9(1950) Apr. 12 (in French).

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The author has studied the reactions produced by thermal neutrons in Li, B, and N, with the aid of loaded nuclear plates. The latent images were partially suppressed in the development by a technique previously described (Compt. rend. 227, 527(1948)). Energies of the particles resulting from these reactions were calculated and compared with the observed ranges. The results are tabulated, and they give several points on the range-energy curve for α particles with energies below 2.1 Mev. To extend these results to α particles with energies between 2 and 4 Mev, the author used Po radiation slowed down by aluminum screens of increasing thickness. These results are also tabulated; the results in general are in good agreement with data obtained at higher energies, but the experimental stopping power of the emulsion is slightly higher than the theoretical value.

4965 Experimental Investigations of the Behavior of Counters Filled with Vapor Only. Ewald Fünfer and Hugo Neuert. Helv. Phys. Acta 23, Supp. 3, 142-9(1950)(in German).

The authors found that Geiger counters filled with vapor only, and not with a gas, have a number of useful properties. The pulse amplitudes are the same as for gas-filled counters, their duration having an upper limit of the order of magnitude of 10^{-7}-10^{-6} sec. The discharges are self-quenching. In contrast to ordinary Geiger counters, a dead time does not occur. Vapor-filled counters are proportional counters with specially high amplifications. The best results were obtained with the use of dimethoxy methane, which because of its high vapor pressure of 90 mm at 10°C and more than 200 mm at room temperature is suitable for filling counters. The dependence of the pulse size on the voltage was measured over a wide range.

4966 Focusing Properties of a Generalized Magnetic Spectrometer. David L. Judd. Rev. Sci. Instruments 21, 213-16(1950) Mar.

The first-order focusing properties of a magnetic spectrograph similar to that of Siegbahn and Svartholm, but differing in that both source and collector lie outside the field, are investigated. The parameters of the analogous thick lens optical system are derived. General expressions for image distance, astigmatism, magnification, solid angle, dispersion, and resolution of lines with a spread in momentum are obtained. Factors affecting the compromise between intensity and resolution are discussed. The possibility of increasing resolution without loss of intensity by introducing some astigmatism is considered. Second-order effects have not been included since they are thought to be of the same order as corrections for the fringing field. The first approximation proved adequate for the design of an instrument in which satisfactory focusing was obtained by simple empirical adjustments. (auth)

4967 High Pressure Ionization Chambers Used in Oxford. L. Beghian, C. H. Collie, H. Halban, and R. Wilson. Helv. Phys. Acta 23, 82-4(1950).

The construction and operation of high pressure ionization chambers, filled with hydrogen, deuterium, or methane are described. Electron collection was used, which necessitated a thorough cleaning and outgassing of the counters before filling. In order to take advantage of electron collection, it was important to minimize the contribution of the positive ions, which was achieved by suitable counter geom-

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etry. Results presented include the differential distribution of pulses from 280-kev protons, in a counter filled with deuterium at 8 atm pressure, and the integral distribution of pulses from a neutron detector, irradiated with 2.5-Mev neutrons and filled with methane at a pressure of 35 atm.

4968 Latent Image of Charged Particles. Pierre Cüer. Science et inds. phot. 21, 161-70(1950)(in French).

An experimental study is described of the latent image formed by a charged particle within the grain of a photographic emulsion, and of the mechanism of the action of the developer on such an image. The effect of the concentration of incident electrons on the properties of the image was studied, as well as the problem of the discrimination between images of various radiations. Another set of experiments dealt with the efficiency of the emulsions; i.e., with the quantitative aspects of the transformation of energy of various radiations during the formation of a photographic image in the grain.

4969 Measurement of Converted γ-radiation by the Proportional Counter Technique. D. Maeder and H. Medicus. Helv. Phys. Acta 23, 175-7(1950).

The use of proportional counters has been extended to very high multiplication factors, making possible the determination of unusually low gamma- and beta-ray energies from pulse amplitude measurements. Whereas for true gamma rays this method always yields the full gamma-ray energy, for converted radiation the full energy is observed only in case the source forms part of a counter filling which absorbs practically all the x-ray quanta following the emission of a conversion electron. The author discusses the complications arising from a source deposited on the counter wall. The experimental method is illustrated by an application to the measurement of the activity of Tc^{99*}.

4970 Measurement of Gamma-ray Energies with One Crystal. John A. McIntyre and Robert Hofstadter. Phys. Rev. 78, 617-19(1950) June 1 (Letter to the editor).

The authors have studied the pulse height distributions in clear NaI(Tl) crystals of various sizes and with various degrees of collimation of the γ rays investigated. The pulses were analyzed by a single channel discriminator in conjunction with the EMI 5032 photomultiplier. Pulse height distribution curves are given Co^{60} γ-ray beams under various degrees of collimation, and these curves show a large amount of fine detail. The interpretation of these curves is discussed.

4971 Measurement of Gamma-ray Energies with Two Crystals in Coincidence. Robert Hofstadter and John A. McIntyre. Phys. Rev. 78, 619-20(1950) June 1 (Letter to the editor).

By means of a coincidence method employing scintillation counters, the energies of Compton recoil electrons produced by γ rays were measured. From the energy momentum relations of the Compton effect the energy of the γ-ray beam was then calculated. The γ-ray spectrum of Co^{60} at 1.17 and 1.33 Mev was determined accurately in this manner. The radium C (Bi^{214}) and Sb^{124} γ spectra were also examined, the results agreeing closely with those of Kern et al (Phys. Rev. 73, 1142(1949)).

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4972 A New Method for the Measurement of Inhomogeneous Magnetic Fields. Peter M. Weinzierl. Rev. Sci. Instruments 21, 492(1950) May.

The author has devised a simple method for the accurate determination of the magnetic field strengths within strong and inhomogeneous fields. This is accomplished by inserting a magnetron into the field at the point at which the field strength is to be measured. When the voltage between the two coaxial cylinders of the magnetron falls below a critical value (a value which is a function of the field strengths), the electrons from the cathode can no longer reach the anode, and the anode current falls sharply. At this voltage there is a sharp dip in anode current when the axis of the magnetron is parallel to the field. Thus the position and magnitude of the field may be determined.

4973 Note on the Automatic Voltage Regulation of Geiger Counters. Claude Brachet. Compt. rend. 230, 2174-6(1950) June 19 (in French).

A voltage regulating device for industrial Geiger counters has been designed, whereby a thyratron discharges when the voltage exceeds a predetermined value, the discharge being used to reduce the voltage of the counter.

4974 On the Beginning of the Geiger Region in Methane Counter. Hugo Neuert. Z. Naturforsch. 5a, 231 (1950) Apr. (Brief note, in German).

In investigations of the pulse amplitudes produced by alpha particles in proportional counters, the author has found that the space charge effect in the region of limited proportionality is very different for alpha particles incident at right angles to the axis of the counter and those incident in a direction parallel to the axis of the counter. The pulse amplitude is plotted for various counter voltages, for alpha particles incident parallel to and at right angles to the counter axis, and also for beta particles. The two alpha particle curves differ appreciably, and their intersection with the curve for beta particles (the threshold for the Geiger region) are slightly different.

4975 On the Identification of High Energy Particles in Electron Sensitive Plates. G. Occhialini. Bull. centre phys. nucl. univ. libre Brux. 1950, No. 11a, Feb. 10p. (in French).

Since the thickest emulsions available cannot stop the very energetic particles to which the newer ones are now sensitive, range cannot help in identification. Information as to identity and energy of particles must be gleaned from grain density and scattering. The author discusses the various types of scattering or deflection observations and the energy ranges in which they are useful. A number of events are illustrated and discussed in which an energetic primary produces a pair of secondaries and continues, with or without deflection. These events are termed giraffes, the small angles of the final tracks to an extension of the original one causing a faint resemblance to a three-legged giraffe.

4976 On the Study of Neutrons from Atomic Piles by Means of the Photographic Method. P. Cüer. Helv. Phys. Acta 23, 74-6(1950).

Emulsions loaded with boron and with lithium may be used for recording small instantaneous fluxes of slow neu-

trons. The nitrogen in ordinary nuclear emulsions makes it possible to measure fluxes of about 10 neutrons/cm^2. The method of photographic plates also furnishes valuable information on the stopping power of various substances for fast neutrons, and on the stopping power of emulsions for charged particles of low energy. The author describes in detail the experimental techniques which may be used in making such measurements.

4977 On the Temperature Dependence of Counter Characteristics in Self-quenching Geiger-Mueller Counters. Om Parkash and P. L. Kapur. Proc. Phys. Soc. 63 A, 457-61(1950) May 1.

A similar article by the author was also published in Phys. Rev. 76, 568-9(1949) Aug. 15 (letter to the editor). An abstract of the letter appeared in Nuclear Science Abstracts as abstract 3-1445.

4978 Pair Production and Photoelectric Effect in Scintillation Phosphors. P. R. Bell. Science 112, No. 2897, 7-9(1950) July 7.

The author analyzes the γ-ray spectrum of Hg^{203}, Cs^{137}, K^{42}, Na^{24}, and TH C'' (Tl^{208}) using a phosphor scintillation counter of sodium iodide activated with thallium.

4979 Portable Geiger Counter for Drill Holes. A. Roberts. Radio Electronic Eng. 13, 16-17,21,28(1949) Sept.

A single-ended self-quenching Geiger Mueller tube with 1 kv applied is mounted on the end of 1000 ft of cable and can be lowered down a 1¼-in. bore hole. The difficulties in making the Geiger-Mueller tube assembly water-proof under 1000 ft of water are briefly discussed. The cable is kept on a drum which rotates the counter. The tube voltage is generated by rectifying the voltage peaks across a choke in one anode circuit of a multivibrator. A 2-stage RC filter smoothes this supply. The tube signal is amplified (2 stages, × 2500). The resulting pulses, which are about 300 μsec long, operate a 2-valve trigger circuit; the second valve of this is a pentagrid which is also fed from a 1-kc/sec neon oscillator. The output is applied through a further valve to a loud speaker and is simultaneously rectified to give a measure of the rate of counting. Batteries are used for power supply.

4980 A Portable Scintillation Spectrometer. Robert W. Pringle. Atomics 1, 49-50(1950) Feb.

This paper describes the construction and operation of a portable scintillation spectrometer utilizing single, activated alkali halide crystals of about 100 g in conjunction with an RCA 5819 wide angle photomultiplier. This instrument is capable of attaining a detection sensitivity of 10^{-10} r/sec which is much higher than the sensitivity of the best Geiger counter system. The author describes various geological applications of this device.

4981 The Precise Use of Proportional Counters over Long Periods of Time. D. H. Wilkinson. Helv. Phys. Acta 23, Supp. 3, 119-23(1950)

This article is similar to one which appeared in J. Sci. Instruments 27, 36-38(1950) Feb. An abstract of the article has been published in Nuclear Science Abstracts as abstract 4-3162.

4982 Principle of a Double-Lens Spectrometer for Beta Rays. W. Bothe. Helv. Phys. Acta 23, 163-4(1950).

This article is similar to one which appeared in Naturwissenschaften 37, 41(1950). An abstract of the article appeared in Nuclear Science Abstracts as abstract 4-2742.

4983 Proportional Counters in a Magnetic Field; an Investigation of the Nuclear Isomerism in Br^{80}. P. Rothwell and D. West. Proc. Phys. Soc. (London) 63A, 539-41(1950) May 1 (Letter to the editor).

In making accurate β-ray measurements with a proportional counter, it is essential that the great majority of the electrons lose all their energy in the counter. This may be accomplished by placing the counter in a magnetic field which coils up the electron track. The authors have investigated the possibilities of such a technique, after having found that the presence of the field did not appreciably alter the characteristics of the counter. This method has been used in an investigation of the isomerism of Br^{80}. It has been established that Br^{80} has a 4.4-hr isomer which decays into the 18-min β-active ground state with the emission of a 49-kev γ ray and a 37-kev γ ray in cascade (Grinberg and Roussinow 1940, Berthelot 1944). The experimental results indicate that the conversion coefficient for the 37-kev γ ray is 1.3, proving that the transition involved is an electric dipole transition rather than a magnetic dipole transition.

4984 A Radiofrequency Spectrograph and Simple Magnetic-Field Meter. R. V. Pound and W. D. Knight. Rev. Sci. Instruments 21, 219-25(1950) Mar.

A simple oscillating circuit with a special feed-back circuit is employed as a tool for the search for and detailed analysis of nuclear paramagnetic absorption lines. The sensitivity approaches the optimum for a given noise band width and particularly useful is the ease of conducting slow, continuous changes of frequency while recording the output data. Spectra having several components at scattered frequencies are thus displayed. Line shapes are unambiguously recorded because of the absence of sensitivity to dispersion. Using protons in water, or solutions containing Li^7, the device can be used as a versatile and extremely precise meter for measuring magnetic field strengths in the range from about 100 to 25,000 oersteds with a minimum of auxiliary equipment. (auth)

4985 The Relationship Between the Size of Nuclear Disintegration Stars and the Mean Energy of the Emitted Particles. K. J. Le Couteur. Proc. Phys. Soc. (London) 63 A, 498-501(1950) May 1.

Nuclear evaporation theory predicts that the mean energy of the protons evaporated from disintegration stars should increase with star size. It is shown that the calculated rate of increase is in agreement with experimental results, being about 0.34 Mev increase per prong between star sizes of 6 to 16 prongs. Since the energy distribution contains a high-energy tail which is not attributed to nuclear evaporation, only particles with energies below 30 Mev were considered. (auth)

4986 Research on Crystal Detectors of Ionizing Radiation: Studies and Application of Scintillation Counters. Third Quarterly Progress Report; February 1, 1950 -

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May 1, 1950. Robert Hofstadter, J. A. McIntyre, and G. S. Brunson. Princeton University, nd. 39p. (AEC File No. NP-1556.)

The γ-ray spectrometer, reported in the Second Quarterly Progress Report, has been greatly improved so that it now can be used as a reliable tool in studying γ-ray spectra. In the course of improving the γ-ray spectrometer, it was found that heretofore unknown resolution of γ rays by NaI(Tl) can be achieved by using a single crystal. This remarkable behavior occurs because it is possible to resolve the full energy of the γ ray from the Compton recoil electron distribution of energies. Pulses giving the full energy of the γ ray arise in two ways. Studies have been made of the rate of decay of NaI(Tl) pulses as a function of temperature. The decay constants and an "activation energy" have been measured. The results indicate that different mechanisms of the scintillation process occur in the inorganic and organic crystals. α-particle pulses and β-particle pulses are compared on an energy basis. The amount of light emerging from a scintillation in a crystal is shown by model studies to be at least 50% of the total light produced in the scintillation. Methods were developed showing that NaI(Tl) can be well preserved against moisture damage by enclosure in lucite. (auth)

4987 Scintillation Counters. O. R. Frisch. Helv. Phys. Acta 23, 150-4(1950).

The subject of scintillation counting is reviewed briefly, with respect to its historical development, and from the standpoint of current research. It is pointed out that improvements are to be expected partly from the development of better multipliers. To achieve high resolution in coincidence work the multipliers should have enough stages to produce an output pulse big enough to be fed into a coincidence circuit without further amplification. More immediate progress is to be expected from the improvement of phosphors both in the direction of brighter pulses and shorter time constants. The development of uniform and transparent crystals will be important for the measurement of particle energies.

4988 Scintillation Counting of Gamma Rays. W. V. Mayneord and E. H. Belcher. Nature 165, 930-1 (1950) June 10 (Letter to the editor).

The significance of absolute counting-rate in the scintillation measurement of γ rays from Ra^{226}, I^{131}, Co^{60}, and Na^{24} was investigated. In view of the small number of photons of visible light per scintillation, the probability of the liberation of an electron would be expected to depend on the optical efficiency of the system. Studies of the effects of varying optical efficiency by adjustment of the aperture of an iris diaphragm confirm this suggestion. The experiments show that under appropriate experimental conditions the observed counting-rates in a scintillation counter exposed to γ rays have absolute significance, and in calcium tungstate are approximately equal to the number of electrons set free in the crystal. This result is in accordance with the known approximately 100% efficiency for counting α or β particles.

4989 Scintillation Counting with Solutions. Hartmut Kallmann. Phys. Rev. 78, 621-2(1950) June 1 (Letter to the editor).

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In the course of an investigation of the fluorescent efficiency of liquid solutions when excited by γ radiation, neutrons, and α particles, special solutions were used which exhibited an efficiency high enough to make them applicable for counting work. Solutions of toluene and xylene with fluorine, carbazole, phenanthrene, and anthracene proved to be nearly equally suitable. Mixtures of these solutions could also be used advantageously. All these solutions had a maximum efficiency at a certain concentration. The efficiency was increased by the addition of paraffin oil to the solutions. The nature of pulses produced by neutrons and α particles is described. Preliminary measurements were made of the time constants of the solutions from which it appears that a very considerable part of the light emission takes place within a period of time smaller than 10^{-7} sec.

4990 Speed Limitations of Geiger-Mueller Counters. Hendrik den Hartog. Helv. Phys. Acta 23, Supp. 3, 124-41(1950). (See also NSA 4-305.)

This paper summarizes the three main speed limitations imposed on the use of Geiger-Mueller counters, viz. the electron transit time, the development of the discharge and the finite rise time of the pulse associated with it, and finally the dead time. This dead time is analyzed more fully for low and high counting rates. Finally, a technique is described for eliminating most of the complications connected with very high counting rates.

4991 Theory of a Magnetic Lens Type Beta-Ray Spectrometer. N. F. Verster. Applied Sci. Research (Netherlands) B1, 363-78(1950).

The behavior of the electrons near the focal plane is investigated in the case of a lens type spectrometer with arbitrary field shape. Spherical and chromatic aberration constants are introduced after some approximations and simple formulas results showing the existence of a well defined ring-shaped focus. A formula for the influence of the earth's magnetic field on the lens strength is also given. The theoretical results are compared with measurements carried out with a short lens spectrometer. A procedure of the alignment of the magnetic lens is described.

4992 Use of Nuclear Magnetic Resonance in the Measurements of Strong Electric Currents. Georges-J. Béné, Pierre-M. Denis, Richard-C. Extermann. Arch. sci. phys. et nat. 3,49-54(1950).

Gyromagnetic ratios of paramagnetic substances may be very accurately determined by nuclear resonance methods. Once this ratio is known for a given substance, the substance may be used for determining the intensity of strong magnetic fields simply by measuring the resonance frequency in the field. The field may be produced by a coil carrying a current to be measured. Such an arrangement is sufficient for relative measurements of current strength. For absolute measurements it is necessary to determine the ratio between current strength and magnetic field strength for at least one known value of current strength.

4993 The Use of Radioisotopes for the Measurement of the Water Equivalent of a Snow Pack. R. W. Gerdel, B. Lyle Hansen, and W. C. Cassidy. Trans. Am. Geophys. Union 31, 449-53(1950) June.

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A radio-telemetering snow gauge has been designed which uses the principle of absorption by water (liquid or solid phase) of the γ emissions from an artificial radioactive isotope. The gauge has been used successfully to measure up to 55 water-equivalent inches of snow by counting the pulses from a suitably located G-M tube. These pulses have been successfully transmitted and relayed by radio. A field installation consisted of a Co^{60} source in a beam-collimating container flush with the ground and a G-M tube and radio transmitter supported on a suitable framework 15 ft above.

4994 The Use of Secondary Electrostatic Focusing in a Magnetic Beta-Ray Spectrograph. R. D. Hill, J. W. Mihelich, and M. T. Pigott. Rev. Sci. Instruments 21, 498(1950) May.

Exposures of many weeks are often required in order to detect low intensity conversion lines with a magnetic 180-deg focusing photographic β-ray spectrograph. The authors describe a modified spectrograph using secondary electrostatic focusing which reduces the exposure time for conversion lines with energies of the order of 100 kev by a considerable factor. The focusing in this instrument is improved by the use of an electrostatic lens placed directly across the electron orbits. The effectiveness of this lens is demonstrated by the change in photographic density produced by the same Ta^{182} line and equal exposure times, when the focusing potential is changed.

4995 Microwave and Electron Physics at the Clarendon Laboratory, Oxford. Gordon F. Hull Jr. Office of Naval Research (London) Technical Report No. ONRL-51-50, Apr. 24, 1950. 8p.

The microwave research at the Clarendon Laboratory consists of two major types: (a) investigations of resonance absorption in paramagnetic crystal ammonium sulphate salts and (b) investigation of ferromagnetic resonance absorption in thin films of iron, nickel, and cobalt. These investigations are carried out with 1.25-cm microwaves. The electron physics research is extensive and varied. In the field of electrical discharges in gases, two types of investigations are in progress, one of high frequency discharges in hydrogen and rare gases, the other on probe studies in plasma; other fields of investigation are on frictional electrification and on microwave amplifiers and generators for millimeter waves. (auth)

4996 The Energy Spectrum of Neutrons from a Po-Be Source. B. G. Whitmore and W. B. Baker. Phys. Rev. 78, 799-801(1950) June 15.

The energy spectrum of neutrons emitted in the $Be^9(\alpha,n)C^{12}$ reaction of a Po-Be source has been determined by the photographic emulsion method. The results agree, on certain assumptions, with the existence of energy levels in the C^{12} nucleus at 2.5, 4.5, and 7.1 Mev. The last two of these are consistently found by other workers, but the existence of the first is sometimes disputed. Possible reasons for the apparent discrepancies in the evidence on this point are discussed. (auth)

4997 Fast Neutron Cross Sections and Nuclear Shells. D. J. Hughes and D. Sherman. Phys. Rev. 78, 632-3 (1950) June 1 (Letter to the editor).

In order to investigate the relation between fast neutron cross sections and nuclear shells, the fast neutron cross sections of a number of isotopes with neutron numbers in the 50 and 82 regions were determined. Most of the elements which were activated were used in solid form in the manner described previously (Phys. Rev. 75, 1781(1949)). Several noble gases were also investigated. The gases were irradiated in a flat glass cylinder, filled to two atmospheres pressure, which was covered with cadmium for fast neutrons, and bare for thermal neutrons. The cylinder was carried from the pile after irradiation to a system where the gas could be transferred rapidly to a space around a thin-walled Geiger counter by freezing and evaporation. The relation of the observed cross sections to the nuclear shell model is discussed. In particular it is brought out that the change of level density at the shell, as indicated by fast neutron capture cross sections, is quite marked and in fact larger than would be expected from other evidence based on binding energy and the statistical model.

4998 High Energy Scattering of Neutrons and Protons. Emilio Segrè. Helv. Phys. Acta 23, Supp. 3, 197-205 (1950).

A summary of the experiments on neutron-proton scattering at 280, 90, and 40 Mev and of proton-proton scattering at 340 and 32 Mev is presented. The measurements, obtained with various techniques, concern the total cross section and the angular distribution of the scattering. Attempts to interpret the experiments by a nucleon-nucleon potential are described. These attempts are successful only to a limited degree. The experimental data are incompatible with the hypothesis of the equality of n−p and p−p interaction. (auth)

4999 Remarks on the Magnetic Scattering of Neutrons. H. Ekstein. Phys. Rev. 78, 731-2(1950) June 15.

The formal calculation of the scattering of neutrons by a magnetized atom leads to a result which is ambiguous in the forward direction. It is shown that, if this singularity is correctly taken into account, apparent discrepancies between macroscopic and atomistic calculations are eliminated. (auth)

5000 Total Cross-Section of Hydrogen and Carbon for 153-Mev Neutrons. A. E. Taylor, T. G. Pickavance, J. M. Cassels, and T. C. Randle. Nature 165, 967-8(1950) June 17 (Letter to the editor).

Neutrons from a proton-bombarded Be target were passed through graphite and polythene rods to determine the C and H total cross sections for neutron absorption. The transmitted neutrons were measured by detecting the protons ejected from a polythene disk with a proportional counter telescope. For 153 ± 3-Mev neutrons, the total cross sections of C and H were found to be 330 ± 3 and 46.7 ± 1.4 millibarns, respectively.

5001 Progress Report for October, November, and December 1949. J. R. Dunning. CUD-47, Mar. 1, 1950. 32p.

Neutron Velocity Spectrometer Transmission Measurements. High-resolution data showed gallium resonances at 100 and 278 ev. The aluminum resonance at 1.5 μsec/m was also investigated. An analytical treatment has been devised to determine the effect of finite resolution upon the transmission curve, suitable for $N\sigma_0$ up to 10. A system for analyzing parahydrogen content has been designed for the p-H_2 cross-section experiment. Neutron diffraction studies on vitreous silica verify a theory of random network structure. Delayed neutrons from fission in the range >0.5 sec were investigated with the cyclo-

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tron and neutron velocity selector. Background has been cut by a factor of 20 in the experiment to determine (n,γ) cross sections with the neutron velocity selector. Coincidence methods are planned to give further improvements.

Neutron Scattering Experiments. Analysis of data was carried on in the Au scattering experiment to obtain the Breit-Wigner parameters. This involves measuring the area of the transmission dip, as well as $\sigma_{eo}\Gamma^2$ and σ_{so}/σ_{to}. An apparatus for observing forward paramagnetic neutron scattering was built, and counter tubes were also constructed and tested.

Analytical Laboratory and Crystal Growing. Samples suitable for study of paramagnetic scattering of neutrons have been prepared. Some experimental tests have been made on the theory of analytical applications of neutron spectroscopy. Scintillation counter crystals (anthracene and stilbene) have been grown from melts.

Radiochemical Laboratories. As^{76} has been prepared from triphenylarsine by Szilard-Chalmers reaction. Tracer study was made on the mechanism of the overbromination of o-creosol.

Instrument Development. A two channel pulse-height selector was built, and a step-function pulser of rise time 2×10^{-8} sec designed. Delay-line coupled amplifiers have been constructed for oscillographic use, having a gain of 16 and 75 Mc bandwidth. An amplifier of gain 250 and 2×10^{-8} rise time was built. A stabilized coincidence circuit which overcomes the problem of "jitter" in the blocking oscillator and gives coincidence resolution of 2.5×10^{-8} sec is now in use. Tests on the variable mercury delay line and associated coincidence apparatus have been made, indicating better than 10^{-8} sec coincidence resolving time. Experimentation on cathodes for the wide-band amplifier tube was conducted.

Light Particle Investigation. The Na^{22} spectrum was found to have a linear Fermi plot down to 25 kev. The Br^{80} and Br^{82} continuous spectra and internal conversion lines were investigated. Counter dead-time with various filling mixtures was determined. The Be^{10} β-spectrum was obtained and seems to be fitted well by Marshak's D_2 correction. The He^6 spectrum gave an end point of (3.23 ± 0.015) Mev and a Fermi plot linear down to 200 kev (ft = 540). A survey of allowed β-transitions was made in an attempt to explain the data by a linear combination of Fermi and G-T interactions. β-γ angular correlation experiments using scintillation counters for detection have been carried out on Na^{22} and Rb^{86}; the results indicate an isotropic distribution. The source chamber for the neutrino experiment has been completed, and the 12-stage electron multiplier assembled and tested, along with associated circuits. A crude β-scintillation spectrometer was constructed. Shielding from r-f and γ radiation of plastic flow counters gave low background in the short-lived β-disintegration experiment, a 5:1 signal to background ratio being obtained. (auth)

5002 Progress Report in Physics for the Period January 1 to September 30, 1949. W. C. Caldwell, J. F. Carlson, G. C. Danielson, E. N. Jensen, J. M. Keller, L. J. Laslett, S. Legvold, and G. Miller. ISC-73, Mar. 23, 1950. 54p.

After recalibrating the magnetic lens β-ray spectrometer, the energies of γ rays from Co^{60} and Zn^{65} were checked, giving energies of 1.16_8 and 1.33 Mev for Co^{60} and 1.11_8 Mev for Zn^{65}. As an experiment preliminary to studying β decays, the spectrum of P^{32} was determined. Work on the β spectra

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of Sr^{90} and Y^{90} showed distinct departures from the Fermi theory. These departures can be explained if the decay is first forbidden according to Gamow-Teller selection rules (spin change of 2 and parity change). Studies of the internal conversion of Se^{75} have indicated that this nuclide has only a single activity. The half-life of Na^{22}, whose decay has been followed for three years, has been determined as 948 days. An electrostatic deflection experiment is in progress to measure the effective fission fragment charge. Detection of particles by photographic plate has suffered from fogging, but photomultiplier detection seems satisfactory. Apparatus is being completed for studying the range-energy relation for fission fragments and for low energy protons. Some work on the production and measurement of thin films is reported. A 180-deg β-ray spectrometer to be used for low energy studies is under construction. The possibility of using ring-focus for momentum discrimination in the thin magnetic lens spectrometer is being studied experimentally as well as theoretically. All the major components for a 12-in. cloud chamber have been completed except the magnetic field coils and the winding of the coils is in progress. Observations using a polarizing microscope and a "counting" technique (analogous to crystal conduction counting, but without any radioactive source) have given some information on the ferroelectric domains in $BaTiO_3$. Measurements on the dielectric constant of $BaTiO_3$ ceramics just above and below the Curie temperature are in partial agreement with existing theory. Experiments on the variation with time of the counting rate of diamonds have been partially interpreted in terms of space charge. The counting of α particles is largely a surface effect and behaves differently from the counting of γ rays. Dislocations in metals are being studied by a mechanical and electrical arrangement, and also by observations using a Bragg dynamic crystal bubble blowing apparatus. Progress on the Iowa State Synchrotron, kevatron, and the liquid air plant for the low temperature laboratory is also reported. 34 references. (auth)

5003 Summary of the Research Progress Meeting of April 13, 1950. Henry P. Kramer. UCRL-695, May 8, 1950. 8p.

Research in the following topics is summarized: excitation functions for Ni^{60} and Cu^{63}; yields of π^+ mesons from various elements bombarded by x-rays.

5004 The So-Called Superbomb. Ulrich Jetter. Physik Blätter 6, 199-205(1950) May (in German).

The physical principles are discussed according to which a bomb can be built which derives its energy from reactions or cycles of reactions of light elements. The energy balance of various feasible reactions is given, and ways are mentioned in which these reactions may be initiated.

5005 Binding Energies and the Energy Surfaces in the Region of the Heavy Natural Radioactive Isotopes. A. H. Wapstra. Helv. Phys. Acta 23, 210(1950).

This article is similar to one which appeared in Physica 26, 32(1950) Jan. An abstract of it has appeared in Nuclear Science Abstracts as abstract No. 4-2427.

5006 Binding Energy of the Triton. Tsi-Ming Hu and Kung-Ngou Hsu. Phys. Rev. 78, 633-4(1950) June 1 (Letter to the editor).

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The authors present results of calculations carried out to investigate the sensitivity of the binding energy of the triton to assumptions about the shape and range of the nucleonic interaction, assuming tensor forces. With this interaction the ground state of the triton is a mixture of eight angular spin functions. A combination of all eight components was taken as trial function in the determination of the interaction energy. The effect of range of interaction on the triton binding energy was investigated for a Yukawa interaction with the interaction constants adjusted to give the correct binding energy and quadrupole moment of the deuteron, and the incoherent neutron-proton scattering cross section. Calculations were also carried out for a Yukawa interaction which gives the correct deuteron binding energy, but assumes central forces only.

5007 Detection of Alignment of Nuclear Spins. O. J. Poppema. Helv. Phys. Acta. 23, 187-9(1950).

The author discusses the problem of detecting the alignment of a system of nuclear spins by means of two different methods. The first method makes use of the fact that the absorption of a neutron by the nucleus depends on the relative spin orientation of neutron and nucleus. The second method involves the investigation of the distribution in space of the emitted radiation with the magnetic field as an axis of symmetry if the nuclear spins are aligned.

5008 The Doublets of N^{15} and O^{16}. D. R. Inglis. Phys. Rev. 78, 616-17(1950) June 1 (Letter to the editor).

The nuclear energy-level spectra (Malm and Buechner, Phys. Rev. 78, 337(1950) are each characterized by two or more doublets having splittings of 30-200 kev and separated by about 1 Mev or more, in the region of excitation 5 to 8 Mev. Experimental evidence indicates that the spin orbit coupling energy is too large for these to be spin-orbit doublets. It is noted that nuclei at the end of the P-shell in the usual shell model (Phys. Rev. 51, 95(1937)) have a much wider gap from the ground level to the first excited state than have other light nuclei. The first known excitation energy, 5 or 6 Mev, seems to be the energy required to excite a nucleon from the p-shell to the next shell. The nuclear spin and magnetic moment of F^{19}, being similar to a proton's, indicate that the next nucleon state is an s-state. In O^{16}, such an excited s-nucleon, if loosely coupled to the remaining $^2P_{1/2}$ hole of the p-shell (similar to N^{15} or O^{15}) would give rise to adjacent states having I = 0 and 1, a sort of doublet which might be called an "intershell j-j coupling doublet." The N^{15} doublet may be interpreted in a similar manner. Alternative explanations are also considered.

5009 Effect of the Nuclear Spin on the Resonance Paramagnetic Absorption in Solutions of Manganese and Copper Salts. S. A. Al'tshuler, B. M. Kozyrev, and S. G. Salikhov. Doklady Akad. Nauk, S.S.S.R. 71, 855-7(1950) (in Russian).

Several authors (Zavoĭskiĭ, Zhur Eksptl. i Teoret. Fiz. 15, 344(1945); ibid. 16, 603(1946); Kozyrev et al, Doklady Akad. Nauk S.S.S.R. 58, 1023(1947); ibid. 60, 567(1948)) have observed the resonance paramagnetic absorption in certain salts (crystals or solutions) placed in a constant magnetic field that interacted with a weak oscillating magnetic field, the two fields being perpendicular to each other. Calculations of the Landé g-factor, based on the above observations, showed that the influence of neighboring atoms' electric field is generally strong enough to uncouple the paramagnetic ion's orbital and spin magnetic moments, leaving only the latter free to precess. The present authors thought that, under certain conditions, it should be possible to reveal the effect of the nuclear spin on the shape of the absorption curve. In order to obtain this, the coupling between the nuclear and the electron spins must not be broken down by too strong an influence of the outer field and the fields of the neighboring atoms. By using sufficiently low frequencies of the oscillating field, weak constant fields could be employed, and sufficiently low concentrations of solutions would serve to lower the effect of neighboring fields. If the conditions of the Zeeman effect in weak fields are realized, the g-factor of the resultant (nuclear and electron) spin will be given by $g = g_e[F(F+1) + J(J+1) - I(I+1)]/2F(F+1)$, where g_e is the Landé factor for the electron cloud, F is the resultant spin, J the total electronic spin, and I the nuclear spin. These considerations were verified by using a 0.5-mole/l aqueous solution of $MnCl_2$ and a frequency of 2.07×10^8 hertz. The resonance curve was obtained by the method of the reaction on the frequency generator, (Al'tshuler et al, Zhur Eksptl. i Teoret. Fiz. 14, 407(1944)). The curve has a narrow maximum corresponding to $g \cong 1$, in accordance with the above formula, ($I = 5/2$ for Mn, and $J = 5/2$ for Mn^{+2}). With a higher concentration, 3 mole/l, the (broad) maximum is at $g \cong 2$; i.e., the effect of the electronic spin still predominates. With $Cu(NO_3)_2$, a 1.6-mole/l solution furnished a curve with several maxima, as was to be expected from the values $I = 3/2$ for Cu and $J = 1/2$ for Cu^{+2}. However, the maxima are very weak. Evidently, the concentration was too high, and the conditions were those corresponding to the Zeeman effect in moderately strong fields.

5010 The Electric Quadrupole Moment of the Deuteron. G. F. Newell. Phys. Rev. 78, 711-14(1950) June 15.

This article is an amplified version of a Letter to the Editor which appeared in the Phys. Rev. 77, 141(1950) Jan. 1. An abstract of the letter appeared in Nuclear Science Abstracts as abstract 4-1527.

5011 Equivalence of Protons and Neutrons in Nuclei. William D. Harkins. Phys. Rev. 78, 634(1950) June 1 (Letter to the editor).

Reiterating his earlier conjecture (J. Am. Chem. Soc. 39, 856(1917)) and taking advantage of data on the abundance of the elements and their isotopes compiled by Brown, the author advances the contention that 99% of all complex nuclei in the universe contain equal numbers of neutrons and protons.

5012 Hyperfine Structure and Nuclear Spins of Tungsten and Tellurium. G. R. Fowles. Phys. Rev. 78, 744-7(1950) June 15.

By the use of enriched isotopes, hyperfine structure in the optical spectra of Te^{123}, Te^{125}, and W^{183} has been observed. Milligram amounts of the isotopes were used in a modified Schüler hollow-cathode discharge tube. In the visible region, 4000 to 6000 A, about a dozen lines of singly ionized tellurium showed hyperfine structure, all of them giving just two components for the odd isotope. Te^{123} and Te^{125} gave identical structures except for a scale factor, the total splitting of the lines of Te^{123} being about 88% of that of Te^{125}. In the spectrum of neutral W, all lines which show the isotope shift for natural W gave just two components with highly enriched W^{183}. The number of hyperfine-structure com-

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ponents, namely two, gives for Te^{123}, Te^{125}, W^{183} a nuclear spin of ½. This was also verified by intensity measurements. (auth)

5013 Magnetic Resonance Absorption in Nitric Oxide. Robert Beringer and J. G. Castle, Jr. Phys. Rev. 78, 581-6(1950) June 1.

The nine-line magnetic resonance spectrum of $N^{14}O^{16}$ is observed at fields in the range of 8600 oersted at a frequency of 9360 Mc/sec. The spectrum arises from magnetic-dipole transitions between Zeeman levels in the $J = \frac{3}{2}$ state of the $^2\pi_{\frac{3}{2}}$ spin component. The line positions allow a determination of the magnetic IJ coupling constant, which is 29.8 ± 0.3 Mc/sec, and the nuclear electric quadrupole coupling, which is −1.7 ± 0.5 Mc/sec. The line position and triplet spacings, which arise from molecular perturbations, are in good agreement with the theory of Margenau and Henry. The absolute intensity of the three stronger lines is measured to be $\chi'' = 1.2 \times 10^{-10}$ which also agrees with theory. (auth)

5014 Magnetic Shielding of Nuclei in Molecules. Norman F. Ramsey. Phys. Rev. 78, 699-703(1950) June 15.

An expression is developed for the magnetic field at a nucleus resulting from the application of an external magnetic field to a polyatomic molecule which has no resultant electron orbital or spin angular momenta in the absence of the external field. The field at the nucleus is not the same as the externally applied field because of the field arising from the motion of the electrons in the molecule. The expression for the electron contribution to the magnetic field is shown to consist of two parts. The first is a simple term that is similar to the diamagnetic correction developed by Lamb for atoms. The second is a complicated one arising from second-order paramagnetism and is analogous to the term dependent on the high frequency matrix elements in the theory of molecular diamagnetism. Under certain circumstances, the second-order paramagnetic term can become quite large. Since both of these terms are altered when the same nucleus is in different molecules, they at least partially and perhaps completely explain the chemical effect that has been reported by various observers in measurements of nuclear moments. For linear molecules, the second-order paramagnetic term is shown to be directly related to the experimentally measurable spin-rotational magnetic interaction constant of the molecule. This relation is particularly valuable in the important case of molecular hydrogen where it is shown that the correction for second-order paramagnetism is -0.56×10^{-5}. When this is added to the Lamb-type term as calculated by Anderson (Phys. Rev. 76, 1460(1949)), the total magnetic shielding constant for molecular H_2 becomes 2.68×10^{-5}. (auth)

5015 Measurement of the Proton Moment in Absolute Units. Harold A. Thomas, Raymond L. Driscoll, and John A. Hipple. J. Research Natl. Bur. Standards 44, 569-83 (1950) June.

By measuring the absolute value of the magnetic field and the frequency required for nuclear resonance absorption in a water sample, the gyromagnetic ratio of the proton has been determined to be $\gamma_p = (2.67528 \pm 0.00006) \times 10^4$ sec^{-1} gauss^{-1}. Using the value $h = (6.6234 \pm .0011) \times 10^{-27}$ erg sec for Planck's constant, the value of the magnetic moment of the proton in absolute units becomes $\mu_p = (1.4100 \pm 0.0002) \times 10^{-23}$ dyne cm/gauss. A combination of the result with recent measurements of the proton moment in Bohr magnetons gives a value of $e/m = (1.75890 \pm 0.00005) \times 10^7$ emu gram^{-1}.

5016 Nuclear Magnetic Moments of the Gallium Isotopes. P. Kusch. Phys. Rev. 78, 615-16(1950) June 1 (Letter to the editor).

In a recent letter with the above title, Béné, Denis, and Extermann (Phys. Rev. 78, 66(1950)) discuss an interpretation of the observed discrepancy between the moments of the isotopes of gallium as determined from magnetic resonance experiments and from observations on the Zeeman effect of the hyperfine structure of gallium in the $^2P_{\frac{1}{2}}$ state. This discrepancy was attributed to an effect produced by the finite size of the nucleus. The author of the present article disagrees with this interpretation. He believes that the discrepancy is caused by differences in the effective magnetic field, modified by diamagnetic, or possibly paramagnetic, effects of the electron configuration in the interior of the different substances used in the two experiments.

5017 Nuclear Magnetic Moments and Shell Structure. Roald K. Wangsness. Phys. Rev. 78, 620-1(1950) June 1 (Letter to the editor).

The author points out that for nuclei with atomic number $Z < 20$ and $Z > 50$, the addition of two neutrons decreases the value of the absolute value of the magnetic moment $|\mu|$, whereas for $20 < Z \leq 50$, $|\mu|$ is increased instead. By comparison of the actual moments with those predicted by the one-body model for the two limiting cases in which the odd particle's spin is parallel or anti-parallel to the orbital angular momentum, it has been found that the actual state function for the odd particle is generally a mixture of those two possibilities. The addition of two neutrons will change the proportions of the mixture and shift the actual magnetic moment toward one or the other of the limits. From an examination of the actual moments the author finds that for $20 < Z \leq 50$ (with the exception of Ag), the proportion of the state with lower orbital angular momentum is increased to that parallel orientation of spin and angular momentum is favored. For $Z < 20$ and > 50 the opposite is true. The author concludes that the qualitative explanation of these facts can best be brought about on the basis of the model of nuclear shell structure proposed by Nordheim (Phys. Rev. 75, 1968(1949)).

5018 Nuclear Magnetic Resonance in Weak Fields. Richard M. Brown. Phys. Rev. 78, 530-2(1950) June 1. (See also NSA 2-1984)

The nuclear magnetic resonance for protons in water was observed in magnetic fields of 6 and 12 gauss corresponding to Larmor frequencies of 25 and 50 kc, respectively. The line width was found to be determined by the frequency of modulation and here was approximately 3 milligauss. The ratio of magnetic fields for resonance was found to agree with the ratio of Larmor frequencies within the experimental error, estimated at 0.01%. (auth)

5019 On the Calculation of Nuclear Levels. Giulio Racah. Helv. Phys. Acta 23, Supp. 3, 229-32(1950).

Nuclear energy levels are calculated on the basis of the assumptions that nuclear forces are charge symmetrical,

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and that the nuclear shell model is correct. The problem does not involve fundamental but only computational difficulties, which are due to the great number of terms which appear in the nuclear configurations. The calculation of the terms energies and the tabulation of the results are greatly simplified by the use of the group-theoretical method developed previously by the author for the calculation of the spectra of atomic configurations.

5020 Saturation of Signals of Nuclear Paramagnetic Resonance. Michel Soutif and Robert Gabillard. Compt. rend. 230, 2012-4(1950) June 5 (in French).

This is a study of the nuclear dispersion signal produced by the bridge and autodyne method and the experimental results of the latter. There is also a discussion of the influence of concentration in paramagnetic ions. (auth)

5021 Spectroscopic Isotope Shift and Nuclear Polarization. G. Breit, G. B. Arfken, and W. W. Clendenin. Phys. Rev. 78, 390-406(1950) May 15.

This article is an amplified version of a letter to the editor which appeared in Phys. Rev. 77, 569(1950) Feb. 15, and was abstracted in Nuclear Science Abstracts as abstract 4-2059.

5022 Theoretical Studies in Nuclear Structure. I. Enumeration and Classification of the States Arising from the Filling of the Nuclear d-Shell. H. A. Jahn. Proc. Roy. Soc. (London) 201 A, 516-44(1950) May.

Using a simple method devised by Racah, the orbital states arising from the filling of the nuclear d-shell in Russell-Saunders coupling are enumerated and, again following Racah, a new classification of the states introduced according to their transformation properties under the group of rotations in the five-dimensional space of the orbital states of a single d-particle is formulated. This new classification acquires significance from the short-range nature of nuclear forces and permits of predictions relating to the order of the levels with attractive forces of short range.

5023 Theory of Magnetic Resonance in Nitric Oxide. Henry Margenau and Allan Henry, Phys. Rev. 78, 587-92 (1950) June 1.

The paper presents a theoretical study of the effect of a magnetic field on the lowest of the $^2\pi_{1/2}$ levels of $N^{14}O^{16}$. The molecular Zeeman effect is calculated in detail and found to yield good agreement with experiment. Consideration is given to the energy of interaction, (a), of the spin of the N^{14} nucleus with the total electronic angular momentum in the external field, and (b) of the quadrupole moment of N^{14} with the electric field at the N^{14} nucleus. The last section contains an evaluation of the matrix elements needed in the computation of absolute intensities for the transitions within the $^2\pi_{1/2}$ level. (auth)

5024 Atomic Piles and Their Use in Nuclear Physics. E. Bretscher. Helv. Phys. Acta 23, 50-69(1950).

An exposition is given of the physics of a multiplicative system based on slow neutron fission, including slowing down and diffusion processes (in the absence of fissile materials), the effect of a multiplying homogenous medium, the time variation of the neutron level in a pile as a whole, and the operation of actual piles. Two applications of the pile as a measuring instrument are described: the determination of the absorption of a specimen, and the absolute calibration of a neutron source with the pile. Then a number of experiments are described which use the pile as a source of neutrons. Slow neutrons are required for neutrons spectroscopy, neutron capture experiments and neutron lifetime experiments. Converters are described by means of which larger numbers of fast neutrons can be made available from a pile. The production of radioactive isotopes and fission products by means of neutron irradiation is discussed; finally, future possibilities are mentioned, including the so-called "dragon," a fast reactor which could be made supercritical for prompt neutrons for a short period only. This very short burst, of the order of 10^{-4} sec could be produced, yielding 10^{15} neutrons, providing at a distance of 100 m still a neutron flux of 107.

5025 Several Characteristics of the Chatillon Pile as a Source of Thermal Neutrons. L. Kowarski. Helv. Phys. Acta 23, 70-3(1950).

The author briefly outlines the structural features of the pile at Chatillon, and describes the neutron flux in various parts of the pile during normal operation. This pile may be used as a source of constant neutron flux, or the reactivity may be periodically varied by means of a neutron absorber oscillating in the tube through which the neutrons pass out of the pile. The periodic operation is described in detail.

5026 Fission Yield Curve of Th^{232} with Pile Neutrons. J. Niday and A. Turkevich. AECD-2862, nd, Decl. June 16, 1950. 8p.

The results of radiochemical analyses determining the yields of 21 products of Th^{232} fission by pile neutrons are reported. 53-day Sr^{89} was chosen as a standard, and yields of all other fission products were calculated relative to an assumed yield of 6% for Sr^{89}.

5027 Alpha-Particles from $^{27}Al + D$. A. P. French and P. B. Treacy. Proc. Phys. Soc. (London) 63, 665-6 (1950) June 1 (Letter to the editor).

Groups of α particles from the reaction $Al^{27}(d,\alpha)Mg^{25}$ have been observed, using a differential ionization chamber with electron collection in argon. A thin target of aluminum, about 0.5 mm air equivalent evaporated on brass, was bombarded with deuterons of 0.93 Mev and the α particles emitted were observed at 90 deg to the incident beam within a cone of semi-angle 10 deg. An air absorption cell of fixed length and variable pressure was mounted between target and chamber, so that particle ranges from 2.0 to 6.0 cm could be measured. A plot of counting rate versus absorber pressure shows five peaks attributable to alpha particles of 4.83, 5.14, 5.64, 5.95, and 6.43 Mev. The Q values are determined and the related energy levels in Mg^{25} are discussed.

5028 Alpha-Particles from ^{19}F Bombarded with Deuterons. A. P. French, P. Meyer, and P. B. Treacy. Proc. Phys. Soc. (London) 63, 666-8(1950) June 1 (Letter to the editor).

The F^{19} + d reaction was studied to determine which resulting α-particle groups were due to the $F^{19}(d,\alpha)O^{17}$ process and which to $F^{19}(d,n)Ne^{20*}$ accompanied by $Ne^{20*} \rightarrow O^{16} + \alpha$. Since, in $F^{19}(d,\alpha)$, most of the kinetic energy is given to the α particle while, in $F^{19}(d,n)$, the neutron carries most of it

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away, the dependence of α-particle energy on deuteron bombarding energy should be quite different in the two cases. Four groups, with Q values of 2.81, 5.26, 6.03, and 6.79 Mev, were found to shift in energy when bombarding energy was changed and were thus to be assigned to $F^{19}(d,\alpha)$, while the fifth remained nearly constant and was attributed to $F^{19}(d,n)$.

5029 The Angular Distribution of Protons from the D-D Reaction at 10 Mev. H. A. Leiter, F. A. Rodgers, and P. G. Kruger. Phys. Rev. 78, 663-7(1950) June 15.

The gas-filled scattering chamber has been applied to the study of the distribution in angle of the protons from the D-D reaction with 9.94 ± 0.08-Mev deuterons from the cyclotron. Photographic plates were used as detectors. The other charged particles produced in the reaction and from scattering processes were prevented from reaching the emulsion by covering the photographic plates with a 53.2 mg/cm² aluminum foil. Differential cross sections were determined at 10-deg intervals from 15 to 65 deg in the laboratory system. Background runs were made to determine the correction necessary because of the flux of neutrons in the chamber. Additional corrections were made for the penetration of the protons through the edges of the defining slit and for geometrical errors. The total cross section for the production of protons was calculated to be 7.3×10^{-26} cm². (auth)

5030 Deuteron Reactions with Separated Neon Isotopes. J. Ambrosen and K. Marck Bisgaad. Nature 165, 888-9(1950) June 3 (Letter to the editor).

Targets with separated neon isotopes prepared by bombardment of silver plates with beams from a mass spectrograph were used to examine the (d,p)-reactions in neon. The energy of the protons was determined from their range in a photographic emulsion.

Process	Proton energy in Mev	Expt. Q-value of reaction
$Ne^{20}(d,p)Ne^{21}$	5.63	4.54
	5.26	4.15
$Ne^{21}(d,p)Ne^{22}$	9.29	8.34
	7.96	6.95
$Ne^{22}(d,p)Ne^{23}$	4.15	2.96

5031 Disintegration of Nitrogen by Fast Neutrons. C. P. Sikkema. Helv. Phys. Acta 23, Supp. 3, 172-4(1950).

This article is similar to one which appeared in Nature 162, 698-9(1948) Oct. 30. An abstract of the article was published in Nuclear Science Abstracts as abstract 2-174.

5032 The Energy-Release in Some ($p\alpha$) Reactions in Light Nuclei. Joan M. Freeman. Proc. Phys. Soc. (London) 63, 668-9(1950) June 1 (Letter to the editor).

Using proton beams of 840 and 940 kev and targets of Al, NaCl, CaF_2, copper oxide, and aluminum nitride, direct measurements were made of the α-particle energies with the aid of a magnetic analyzer. The respective reactions and derived Q values were

$Al^{27}(p\alpha)Mg^{24}$	1.585 ± .015 Mev
$Na^{23}(p\alpha)Ne^{20}$	2.35 ± .04
$F^{19}(p\alpha)O^{16}$	8.06 ± .04
$O^{18}(p\alpha)N^{15}$	3.97 ± .05
$N^{15}(p\alpha)C^{12}$	4.96 ± .05

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5033 Evidence for the Photodisintegration of Copper with the Emission of Protons. Raymond Chastel. Compt. rend. 230, 2020-2(1950) June 5 (in French).

A thick foil of copper was placed between 2 photographic plates and irradiated with the γ rays produced by bombarding lithium with 500-kev protons. Correcting for the γ,n reaction in copper and a small number of n,p reactions, a preliminary value for the cross section, σ for the γ,p reaction was calculated to be 1.0×10^{-27} cm² with a maximum proton energy in the order of 8 to 9 Mev. Taking $\sigma(\gamma,n)$ for Cu to be 7.75×10^{-26} cm², the ratio $\sigma(\gamma,n)/\sigma(\gamma,p)$ is about 77, much smaller than the theoretical value.

5034 Photographic Plate Evidence for the γp-Reaction in Be^9. E. W. Titterton. Nature 165, 721-2(1950) May 6 (Letter to the editor).

The three-stage reaction: $Be^9(\gamma,p)Li^8$; $Li^8(\gamma)Be^{8*}$; $Be^{8*} \rightarrow 2He^4$, produces three-prong stars in photographic emulsions which are not electron sensitive. Such stars have been observed in beryllium-loaded Ilford plates type C_2 and E_1 irradiated with 24-Mev γ rays from the synchrotron at Harwell. A photomicrograph of one such event is reproduced. The distribution in range of the protons emitted in the observed stars is graphed, but no conclusions can be drawn as to the variation in cross section with the incident energy because of the large number of protons which escaped from the emulsion. However, the mean value of the cross section over the energy range 18 to 24 Mev can be calculated from the results and is $(2.5 \pm 1.0) \times 10^{-28}$ cm². The proton distribution indicates a threshold for the reaction at about 18 Mev, a result in agreement with the figure 18 ± 1 Mev given by Ogle and Conklin (Phys. Rev. 71, 378(1947); 73, 648 A(1948)). A histogram of the total energy release in the break-up of the Be^9 nucleus into two α particles is given, and the general features of this diagram are in good agrrement with the results of Franzinetti and Payne (Nature 161, 735(1948)).

5035 The Spallation Products of Antimony Irradiated with High-Energy Particles. M. Lindner and I. Perlman. Phys. Rev. 78, 499-508(1950) June 1.

The distribution and yields have been determined for a considerable number of spallation products resulting from the irradiation of antimony with particles in the 100-Mev range. The highest yields were found for nuclei about five mass numbers removed from the target material showing that compound nucleus formation is not an important mechanism in such high energy reactions. Products in lower yields were found which probably resulted from nuclei which had been excited to the full energy of the projectile. A more detailed discussion of the types of reactions responsible for the observed products is given. (auth)

5036 The Angular Distribution of Synchrotron Target Radiation: A Preliminary Experimental Study. J. D. Lawson. Proc. Phys. Soc. (London) 63, 653-60(1950) June 1. (See also NSA 4-5039.)

The angular distribution of radiation from a synchrotron has been measured with an ionization chamber for a number of different target materials and thicknesses, and the results have been compared with a simple theory in which the radiation from a parallel beam of electrons striking a thin plate has been calculated. Detailed comparison with theory is not possible, because the precise way in which the electrons hit

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the target cannot be determined, nevertheless qualitative explanations have been found for most of the effects observed. The most important of these is the relative insensitivity of forward intensity and beam width to target size and material. (auth)

5037 An 80-Mev Model of a 300-Mev Betatron. D. W. Kerst, G. D. Adams, H. W. Koch, and C. S. Robinson. Rev. Sci. Instruments 21, 462-80(1950) May.

The construction and operation of a flux-biased 80-Mev betatron is described. This betatron was built as a model to test design features later to be incorporated in a 300-Mev betatron. Particular attention is paid to factors influencing design and to considerations of magnetic problems which are common to betatrons and synchrotrons such as the construction of field magnets which are uniform, the testing of fields at injection time, the mechanism of electron capture, and the influence of field inhomogeneities. The dimensions and operating characteristics are included together with many comparisons with the 300-Mev betatron. (auth)

5038 High Energy Accelerators. Edwin M. McMillan. Helv. Phys. Acta 23, Supp. 3, 11-26(1950).

This review article deals with high energy machines in which essential use is made of time-varying fields for the acceleration of particles. The emphasis is on resonance accelerators, especially the cyclotron and its various modifications, the synchrotron, synchro-cyclotron, and the bevatron (Berkeley). Numerous photographs and diagrams illustrate constructional details of these machines.

5039 Measurement of Polar Diagram of Synchrotron Gamma Radiation. D. J. Lees and L. H. Metcalfe. Proc. Phys. Soc. (London) 63, 661(1950) June 1 (Letter to the editor).

The variation of synchrotron gamma-radiation intensity with angle from the forward direction was determined. Polar diagrams illustrate the distribution in both the horizontal and vertical planes. This report supplements that of Lawson, abstracted as NSA 4-5036.

5040 Research Program with the Chicago Cyclotron; Progress Report, August 1, 1948, to August 1, 1949. University of Chicago Institute for Nuclear Studies, nd. 128p. (AEC File No. NP-1493.)

Research in physics and chemistry, the operation and reconstruction of the cyclotron, and the operation of the Electronics Laboratory are reported.

5041 Synchrotron Radiofrequency System. Mitchell H. Dazey, Jack V. Franck, A. C. Helmholz, Craig S. Nunan, and Jack M. Peterson. Rev. Sci. Instruments 21, 436-9(1950) May.

The author describes the radiofrequency system of the Berkeley synchrotron. This description includes an outline of the general specifications as well as a detailed discussion of the design and operation of the quarter-wave resonator and associated circuits used in the radiofrequency oscillator. A schematic diagram of the oscillator is given.

5042 Theory of the Capture Process in a Betatron-Injected Synchrotron. David C. de Packh and Milton Birnbaum. Rev. Sci. Instruments 21, 451-6(1950) May.

The investigation of electrons of all possible initial phases and phase velocities at transition between betatron and synchrotron phases of an electron synchrotron has been undertaken with a view toward determining the effect of different ways of applying the r-f. It has been found that for an average accelerator there is an advantage in a moderately slow increase of the voltage from zero to its final value; while for the extreme case where particles enter the transition region with large phase velocity, an asymptotic final radial oscillation amplitude is reached which is independent of the manner in which the voltage is applied, provided only that it is applied adiabatically. (auth)

5043 University of Illinois Cyclotron Oscillator. G. F. Tape. University of Illinois Technical Report No. 1, May 1950. 47p. (AEC File No. NP-1582.)

A report on the design, construction, and operation of the tuned-plate tuned-grid radio-frequency power oscillator now used with the University of Illinois cyclotron is given. This unit is simple in mechanical and electrical design, is free of parasitic oscillations, requires small maintenance time, and requires only minimum changes for changes in frequency. Also included are experiences gained with a grounded-grid oscillator tried with the cyclotron in late 1947 and found to be unsuccessful due to ion loading in the cyclotron vacuum chamber. (auth)

5044 Deuteron-Proton Scattering Using Photographic Techniques. F. A. Rodgers, H. A. Leiter, and P. G. Kruger. Phys. Rev. 78, 656-62(1950) June 15.

The differential scattering cross section for 9.94 ± 0.08-Mev deuterons scattered by protons has been determined with nuclear track emulsions as detectors. The deuterons were obtained from the cyclotron while the target consisted of hydrogen gas at a pressure of approximately 5 cm of mercury. The photographic plates were arranged so that they recorded simultaneously at all laboratory angles from 12.5 to 65 deg. Approximately 5000 proton tracks at each of 12 angles in this range were counted. Geometrical, slit scattering, and slit penetration corrections have been made to the number of tracks counted. (auth)

5045 The Diffusion of γ Rays in Water. Experimental Study. Paul Maignan. Compt. rend. 230, 2088-90 (1950) June 12 (in French).

A sample of thorium was placed in a tank of water and the γ rays were counted at distances ranging from 50 to 200 cm. It is believed that almost all those counted are due to the 2.62-Mev γ rays emitted by the thorium. The results were checked against the theoretical formula for γ attenuation derived by the author (Compt. rend. 230, 2018-20(1950) June 5) and good agreement was obtained considering the approximations involved in the theoretical derivation. Experiments are in progress to check the energy spectrum.

5046 The Diffusion and Propagation of γ Rays in an Unlimited Homogeneous Medium. Paul Maignan. Compt. rend. 230, 2018-20(1950) June 5 (in French).

An expression for the flux and energy of photons emerging from a sphere of radius r is derived in terms of the average cosine of the angle, φ, for each scattered beam. $\overline{\cos \varphi_n}$,

where n refers to a beam of photons all of which have been scattered n-1 times, is evaluated by numerical integration. Only Compton scattering is considered.

5047 The Maximum Range of High Energy Electrons in Aluminum and Copper. Frank L. Hereford and Charles P. Swann. Phys. Rev. 78, 727-31(1950) June 15.

The practical maximum range of monoenergetic electrons in aluminum and copper has been measured in the region of energy from 3 to 12 Mev. The magnetically analyzed β-ray spectrum of B^{12} was employed, range values being determined from absorption curves obtained with a triple coincidence counter train. The values so obtained fall below a semiempirically computed curve normalized with experimental data in the region of electron energy below 3 Mev. It is shown that the discrepancy can be explained if the influence of multiple scattering effects in the absorber is considered. On this basis the data indicate that the difference between the "absolute maximum range" and the "practical maximum range" increases with electron energy. (auth)

5048 Multiple Scattering in an Infinite Medium. H. W. Lewis. Phys. Rev. 78, 526-9(1950) June 1.

The integro-differential diffusion equation of the multiple scattering problem in an infinite, homogeneous medium, is studied without the usual small-angle approximation. An expansion in spherical harmonics is carried out which is rapidly convergent in the case of large-angle scattering, whose coefficients can be exactly determined, and which leads to expressions for the various moments of the spatial and angular distributions. The latter alone has previously been obtained by Goudsmit and Saunderson, and, in the small-angle approximation, by Snyder and Scott. The results are shown to include these. (auth)

5049 Nuclear Recoil Momentum in Pair Production. B. Rosenbaum. Phys. Rev. 78, 628(1950) June 1 (Letter to the editor).

The author computed by numerical evaluation of results of Bethe (Proc. Roy. Soc. (London) 146 A, 83(1934)) the probability distribution ϕ (p) of the nuclear recoil momentum p in pair production in air, at various γ-ray energies. A graph is given of the distribution at 10.2 Mev. It appears that the approximate formula ϕ (p)dp = const.dp/p, valid for high energies, is a poor approximation to the correct distribution at 10.2 Mev. The concentration of momentum transfers in the neighborhood of the minimum momentum was found to increase with increasing quantum energy, so that the median momentum decreases. In a recent experiment of Modesitt and Koch (Phys. Rev. 77, 175(1950)) at energies from 3 to 19.5 Mev, no such variation of median momentum with energy was observed. The median momenta observed by them were larger than those predicted theoretically, the difference being greatest in the highest energy range, from 17.0 to 19.5 Mev.

5050 On the Detection of γ-Ray Polarization by Pair Production. T. H. Berlin and L. Madansky. Phys. Rev. 78, 623(1950) June 1 (Letter to the editor).

The possibility of detecting the polarization of γ rays by means of pair production is investigated theoretically. A measure of the polarization is provided by the ratio of the cross section for the pair to appear in a plane perpendicular to the plane of polarization, to the cross section for the plane of the pair to be parallel to the plane of polarization. This ratio, as a function of the degree of polarization, is calculated for a number of experimental arrangements.

5051 On the Energy Loss by Fission Fragments Along Their Range. N. O. Lassen. Kgl. Danske Videnskab. Selskab, Mat. fys. Medd. 25, No. 11, 1-42(1949).

This article is an amplified version of a letter to the editor which appeared in Phys. Rev. 75, 1762(1949) June 1. An abstract of the letter was published in Nuclear Science Abstracts as abstract 3-1137.

5052 Pair Production in the Field of the Electron by X-rays from a 100-Mev Betatron. E. R. Gaerttner and M. L. Yeater. Phys. Rev. 78, 621(1950) June 1 (Letter to the editor).

The authors made a study of positron-electron pair production in the field of the electron in air by x-rays ranging in energy from 5 to 20 Mev, and from 20 to 100 Mev. They observed, by means of a cloud chamber, the ratio of pairs to triplets, a triplet being defined as a pair with a visible electron recoil which indicates the pair to have been formed in the field of the recoiling electron. With the cross section of total pair plus triplet production $\sigma \sim Z(Z + A)$, Z being the atomic number, the constant A was found to be 0.75 for the energy range 5 to 20 Mev, and 0.8 for the range 20 to 100 Mev. A comparison is made with theoretical values obtained by Borsellino (Helv. Phys. Acta 20, 136(1947)) and Wheeler and Lamb (Phys. Rev. 55, 858(1939)), according to which, in the two energy ranges, $A = 0.61$, and $0.80 < A < 0.86$, respectively.

5053 Proton-Proton Scattering at 5 Mev. R. E. Meagher. Phys. Rev. 78, 667-73(1950) June 15.

The differential cross section for the scattering of protons by protons has been measured at an energy of 4.96 ± 0.08 Mev, at angles from 12.5 to 55 deg in the laboratory system. The scattering medium was hydrogen gas at a pressure of approximately 5 cm Hg. The scattered or recoil protons were detected by nuclear track photographic plates. Approximately 10,000 proton tracks were counted at each angle of observation. An estimate indicates the error of each individual cross section to be about 2%. Because the observations at each angle are made simultaneously, the relative accuracy from one angle to another is smaller and amounts to about 1.3%. (auth)

5054 The Half Life of Strontium^{90}. Ruth I. Powers and A. F. Voigt. AECU-840, May 1, 1950. 3p.

The decay of several samples of Sr^{90} has been followed for 7 yr with a Lauritzen electroscope. The half-life obtained, 19.93 ± 0.3 yr, is significantly different from the value currently accepted, 25 yr.

5055 Radioactive Isotopes of Gadolinium. R. E. Hein and A. F. Voigt. AECU-843, nd 17p.

A 236-day neutron induced activity in gadolinium purified by ion exchange methods has been assigned to Gd^{153}. The activity decays by K electron capture emitting a 106-kev γ ray giving rise to K and L electron groups. A 7.2 ± 0.2 day and approximately 24-hr activity present in the neutron bombarded gadolinium were separated on an ion exchange

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column. The 7.2-day activity assigned to Tb^{151} decays by emission of 0.50-Mev β particles. The 24-hr activity has been tentatively assigned to Gd^{159}. Half-life measurements on gadolinium produced by deuteron bombardment of europium extend over 600 days. The activity decaying with a half-life of 155 days initially is slowly lengthening into a longer half-life. A 265-kev γ ray was detected in addition to the 106-kev γ ray previously found in Gd^{153}. This 265-kev γ ray has been assigned to Gd^{151} which decays with a half-life of 150 days. This half-life is based on ratios of the 106 kev γ ray to the 265-kev γ ray observed over a 600-day period. (auth)

5056 Radioactive Isotopes of the Rare Earth Elements. Part III. Holmium Isotopes. Geoffrey Wilkinson and Harry G. Hicks. UCRL-677, Apr. 27, 1950. 9p.

A study has been made of neutron deficient radioactive isotopes of holmium produced by α-particle bombardments of terbium, and by proton and deuteron bombardments of dysprosium. In the following table, which summarizes the production and properties of the holmium activities, energies of electrons and γ rays were obtained from aluminum and lead absorption measurements; positron energies were obtained from a β-ray spectrometer:

Isotope	Type of Radiation	Half-Life	Energy of Radiation in Mev: Particles	γ Rays	Produced by
Ho^{160}	β^+ K,e^-,β^+ (0.5%), γ	22.5 ± 0.5 min.	0.17(e^-) ~1.3 (β^+)	~1.2	Tb-α-3n
Ho^{161}	K,e^-, γ	4.6 ± 0.1 hr	~0.1 (e^-)	1.1	Tb-α-2n Dy-p-n Dy-d-2n
Ho^{162}	K, β^-(~15%),e^-, γ	65 ± 0.5 days	~0.1 (e^-) 0.8 (β^-)	~1 (weak)	Tb-α-n Dy-p-n Dy-d-n, 2n
Ho^{163}	K,e^-,γ^-	5.2 ± 0.05 days	0.4	0.4-0.5 1.4	Dy-p-n Dy-d-n, 2n
Ho^{164}	β^-	34.0 ± 0.5 min.	0.95		Dy-p-n

5057 α - γ Angular Correlation. Jacques Thirion. Compt. rend. 230, 2090-2(1950) June 12 (in French).

The α - γ angular correlation for a disintegrating nucleus is derived for arbitrary multipole order. The author states that the calculations can easily be generalized to other nuclear reactions or α - β correlation where internal conversion takes place.

5058 An Absorption Comparison of the β-Particle Spectra of $^{207}_{81}$AcC″ (allowed), $^{210}_{83}$RaE (second forbidden) and 3.5 yr. $^{204}_{81}$Tl (third forbidden). H. D. Evans. Proc. Phys. Soc. (London) 63, 575-85(1950) June 1.

Experiments are described in which a direct comparison is made by an absorption method of the β-particle spectra of Tl^{207}, Bi^{210} and 3.5 yr. Tl^{204} representing allowed, second forbidden, and third forbidden transitions, respectively. New values of 623 ± 4 mg/cm² and 300 ± 3 mg/cm² are proposed for the absorption limits in aluminium of the β particles emitted by Tl^{207} and Tl^{204} and it is shown that, of the three elements, Bi^{210} emits most and Tl^{207} least low energy electrons. An attempt has been made to derive energy distributions from the absorption curves, but the results for Bi^{210} depart markedly from those obtained with magnetic spectrographs. The general findings, however, agree with those of other workers who have attempted the same procedure. (auth)

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5059 Beta-Gamma Angular Correlation. Stuart L. Ridgway. Phys. Rev. 78, 821(1950) June 15 (Letter to the editor).

Beta-gamma angular correlation was investigated for a number of isotopes by means of a coincidence-counting arrangement using scintillation counters and a coincidence circuit of 0.1-μsec resolution, consisting of blocking oscillator pulse shapers and a pentode mixing stage. Counts were taken at 180 and 90 deg, the γ-counter being moved, and the coincidence rate was normalized by the single counting rate in each channel to compensate for solid angle variation and slight drifts in counter efficiency. Assuming a correlation function ($1 + b \cos^2 \theta$), the results can be summarized thus:

Nucleus	Source thickness mg/cm²	b	Standard deviation
Au^{196}	0.02	+0.004	0.015
Rb^{86}	1.0	+0.019	0.014
Sb^{122}	0.2	+0.011	0.013
Sb^{124}	0.2	−0.168	0.025

5060 Copper 61 and 67. D. N. Kundu and M. L. Pool. Phys. Rev. 78, 488-9(1950) May 15 (Letter to the editor).

A sample of nickel oxide enriched in Ni^{64} to 80.6% from the low natural abundance of 1.16% was bombarded with approximately 20-Mev α particles. The decay curves of the copper fraction, after chemical separation, were followed by means of Geiger counters and a Wulf electrometer and showed activities with half-lives of 3.4 hr (through 8 half-lives) and 2.44 ± 0.02 days (through 12 half-lives). There was also a long period of low intensity but no 12.8-hr Cu^{64} activity. The 3.4-hr copper activity is confirmed at Cu^{61}, derived from the reaction Ni^{58} (α p)Cu^{61} on the 11.5% of Ni^{58} present in the target sample. The 2.44-day half-life must be assigned to Cu^{67} produced by the reaction Ni^{64}(α p)Cu^{67}. This assignment is further substantiated by fast neutron bombardments of zinc oxide containing zinc enriched in Zn^{67} to 56.0% from its natural abundance of only 4.07%. The decay curve of the copper fraction showed the 2.44-day half-life in addition to the 12-hr and a long period. The 2.44-day activity clearly arises from the reaction Zn^{67}(n,p)Cu^{67}.

5061 Correlation in the Direction and Polarization of Two Successive Quanta for Rh^{106}, Co^{60}, and Cs^{134}. A. H. Williams and M. L. Wiedenbeck. Phys. Rev. 78, 822(1950) June 15 (Letter to the editor).

The authors determined the correlation between the polarization of one quantum and the direction of emission of the other for the two successive gamma rays of Rh^{106}, Co^{60}, and Cs^{134} using a polarimeter of a type described by Deutsch and Metzger (Phys. Rev. 74, 1542(1948)). The experimental results for Co^{60} indicated that both transitions are electric, and that the parities of the two excited states are the same as those of the ground state. In the case of Cs^{134}, no polarization correlation was observed. This would indicate that one transition was electric and the other magnetic if both were assumed

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quadrupole. The results for Rh^{106} were in agreement with those obtained by Deutsch and Metzger.

5062 The Disintegration of Cu^{61}. George E. Owen, C. Sharp Cook, and Paul H. Owen. Phys. Rev. 78, 686-90(1950) June 15.

By the use of very thin and uniform sources that were prepared by thermal evaporation, the positron spectrum of Cu^{61} continues to show an excess of particles in the low energy region. The presence of nuclear γ-rays and internal conversion electrons indicates that the disintegration of Cu^{61} is complex. Magnetic spectrometer studies of the radiations from Cu^{61} lead to a tentative disintegration scheme. (auth)

5063 Double Beta-Decay of Te^{130}. Mark G. Inghram and John H. Reynolds. Phys. Rev. 78, 822-3(1950) June 15 (Letter to the editor).

The authors report the isotopic composition of xenon extracted from 371 g of a 1.5×10^9-year-old mineral containing 70% Bi_2Te_3. Compared to the normal isotopic distribution, excess xenon was distributed among the isotopes Xe^{129}, Xe^{130}, and Xe^{131}. The excess of Xe^{129} and Xe^{131} is probably caused by (n,γ) reactions on Te^{128} and Te^{130}. To account for the neutron flux required to produce this much xenon, it is necessary to assume that there was a considerable amount of uranium in the immediate neighborhood of the tellurium mineral. The excess Xe^{130} is attributed to double beta decay of Te^{130}. There appears to be no other explanation for its formation. Assuming an age of 1.5×10^9 yr for the Bi_2Te_3, the excess Xe^{130} present corresponds to double beta decay of Te^{130} with a half-life of 1.4×10^{21} yr. This result is to be compared with the theoretical half-lives of 6×10^{14} and 10^{24} yr, the former computed from the Majorana theory of the neutrino, and the latter from the Dirac theory.

5064 The Gamma-Rays from Be^9 (α,n). R. W. Pringle, K. I. Roulston, and S. Standil. Phys. Rev. 78, 627 (1950) June 1 (Letter to the editor).

A scintillation γ-ray spectrometer was applied to the study of high energy γ-rays which give rise to electron pairs in the scintillation element of NaI(Tl), as a result of their interaction with the I atoms in the crystal lattice. The total kinetic energy of the pairs appears as the energy of pair production when the differential pulse-height distribution of the crystal scintillations is examined in an arrangement similar to one described previously (Phys. Rev. 77, 409(1950)). The ThC'' γ ray of 2.62 Mev was used for the purpose of calibration. An examination of the γ ray resulting from the reaction $Be^9(\alpha,n)C^{12}$ indicated the presence of an excited level of C^{12} at 4.40 ± 0.05 Mev and the absence of other levels except those at 7.2 Mev. The results are in complete agreement with those of Bradford and Bennett (Phys. Rev. 77, 753(1950)).

5065 Gamma-Radiation from Ne^{23}. V. Perez-Mendez and H. Brown. Phys. Rev. 78, 812-13(1950) June 15 (Letter to the editor).

A γ ray of energy 3.0 ± 0.5 Mev was found in Ne^{23} and is suggested as arising from the transition of the daughter Na^{23} to its ground state. Agreement is found with the difference between the two β-ray energies of Ne^{23} reported by the same authors in a letter on the same page, indicating β decays to a ground and an excited state in Na^{23}. Configurations of the various nuclei on the shell structure model are discussed.

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5066 The Half-Life of Cm^{242}. G. C. Hanna, B. G. Harvey, and N. Moss. Phys. Rev. 78, 617(1950) June 1 (Letter to the editor).

During recent work on the neutron irradiation of Americium it was noticed that the Cm^{242} produced decayed at a rate significantly different from that expected from the published half-life of 150 days (Seaborg and Perlman, Rev. Mod. Phys. 20, 639(1948)). For this reason the authors have attempted to measure this half-life accurately. Three sources were available whose disintegration rates were known with adequate accuracy at a sufficiently early date to give a good value for the half-life. The activity of the sources was measured in a low geometry proportional counter using a 30-channel pulse analyzer. Activities were measured at intervals of about 109-200 days and the results are tabulated along with the calculated half-life for each source. The authors estimate the half-life to be 162.5 ± 2 days.

5067 Investigations on Radioactive Decay of the Isotopes of Technecium. Heinrich Medicus, Peter Preiswerk, and Paul Scherrer. Helv. Phys. Acta 23, 298-346 (1950)(in German).

The radioactive transmutations of the isotopes of Tc with mass numbers 92, 94, 95, and 96 were investigated thoroughly by means of spectrometric, coincidence, and absorption measurements, and also by means of a cloud chamber. Complete energy level schemes were determined for all isotopes with the exception of Tc^{92}. Moreover, two isomers of Tc were examined: one of them the well known isomer of Tc^{97}, the other a newly discovered isomer of unknown mass number with a half-life of 51 min and an excitation energy of 34.4 kev. The experimental results are reviewed in the light of the shell model of nuclear structure. 46 references.

5068 A Long-Lived Zirconium Activity in Fission. E. P. Steinberg and L. E. Glendenin. Phys. Rev. 78, 624-5 (1950) June 1 (Letter to the editor).

The authors have isolated from uranium fission a zirconium activity of $\sim 5 \times 10^6$-yr half-life, emitting β rays of 60 ± 5-kev maximum energy. The activity is probably due to Zr^{93}. Uranium was irradiated for 10 months in a pile. The separation was carried out 4 yr after the end of the irradiation, at which time the activity of 65-day Zr^{95} had decayed to a sufficiently low intensity to make the long-lived activity observable. Assuming the long-lived fission product to be Zr^{93}, whose fission yield in uranium may be obtained from the smooth yield-mass curve, the ratio of its activity to that of Zr^{95} at a given time permits the calculation of its half-life, which lies in the range 1.5 to 8.5×10^6 yr.

5069 Magnetic Analysis of Disintegration Products. W. W. Buechner. Helv. Phys. Acta 23, 167-8(1950).

An annular magnet, in which use is made of 180 focusing, was employed for the study of charged particles from several nuclear reactions. The energies of the first energy levels in Li^7, Be^{10}, C^{13}, and O^{17} were found to be (0.483 ± 0.003), (3.375 ± 0.015), (3.098 ± 0.008), and (0.876 ± .009) Mev, respectively. The energies involved in a number of reactions were measured. The following values were obtained for reactions that lead to the formation of the residual nuclei in their ground states, the values in Mev being:

$Li^6(d,p)Li^7$: 5.006 ± 0.014	$Li^7(d,p)Li^8$: −0.193 ± 0.008
$Be^9(d,\alpha)Li^7$: 7.145 ± 0.024	$Be^9(d,p)Be^{10}$: 4.576 ± 0.012
$C^{12}(d,p)C^{13}$: 2.729 ± 0.009	$O^{16}(d,p)O^{17}$: 1.925 ± 0.008

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5070 On the Ratio of the Probability for Positron Emission to the Probability of K Capture (Rapport D' Embranchement): Case of Permitted Transitions (II). R. Bouchez, S. R. de Groot, R. Nataf, and H. A. Tolhoek. J. phys. radium 11, 105-19(1950) Mar. (in French).

The authors discuss the calculation of transition probabilities for electron capture and positron emission in permitted transitions; they consider in detail the relations between the nuclear angular momentum and the nuclear matrix elements in permitted and forbidden transitions. New experiments which they have carried out with Cu^{61} have enabled the authors, in first approximation, to eliminate the difficulties which they have pointed out in a previous article (J. phys. radium 10, 110(1949)). The experimental results on the ratio of probabilities for Cu^{61}, Cu^{64}, and Cu^{67} are in agreement with the theoretical values.

5071 Radioactive Isotopes of Nitrogen. A. G. Lundin and M. B. Neĭman. Uspekhi Fiz. Nauk 40, 40-75(1950) Jan. (in Russian).

Radioactive isotopes of nitrogen are described in a review article mentioning 128 references of which 15 are Russian.

5072 The Radioactivity of Fluorine 20. J. V. Jelley. Proc. Phys. Soc. (London) 63A, 538-9(1950) May 1 (Letter to the editor).

The β- and γ-radiation emitted by F^{20} (half-life 12 sec) has been studied by absorption, coincidence, and spectrometer techniques. The F^{20} was produced by the $F^{19}(d,p)F^{20}$ reaction, the deuteron beam being interrupted periodically to give convenient counting periods. The upper limit of the β-particle spectrum was found to be 5.03 ± 0.05 Mev by the spectrometer and 4.96 ± 0.08 Mev by absorption in Al. Gamma rays of 1.64 ± 0.05 Mev and 2.45 ± 0.06 Mev with an intensity ratio of (8.4 ± 2.6) to 1 were found by absorption of their secondary electrons in Al; the energy of the more intense radiation was also measured with the spectrometer and found to be 1.64 ± 0.02 Mev. A β-γ coincidence experiment confirmed the earlier result (Proc. Camb. Phil. Soc. 36, 252(1940)) that the main β-particle spectrum is linked with an excited state of Ne^{20}. The author proposes a decay scheme based on these experimental results. In addition, an independent experiment on the energy release in the $F^{19}(d,p)F^{20}$ reaction indicated that the mass of F^{20} is 20.00606 ± 0.00008.

5073 Specific Activity of Potassium. William R. Faust. Phys. Rev. 78, 624(1950) June 1 (Letter to the editor).

Absolute beta and gamma disintegration rates of potassium were measured by immersing counters in a tank of water containing 4.55 kg of KCl in solution. The observed disintegration rates were 31.2 ± 3.0 β-rays/sec g, and 3.6 ± 0.4 γ-rays/sec g.

5074 The Construction of Relativistically Invariant η- and S-Matrices for Several Particles. K. Wildermuth. Z. Physik 127, 551-62(1950)(in German). (See also NSA 4-4110, 4111, 4112.)

In continuation of previous work (Z. Physik 127, 92 and 122 (1949)) it is shown that the relations holding for S-matrixes for several particles are also valid for the corresponding η-matrixes. By a relativistic generalization of these relations, η-matrixes for several particles can be constructed, which

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are in accord with the principle of relativity. From these η-matrixes one can then go back to the corresponding S-matrixes.

5075 Deuteron Photoeffect at High Energies. L. I. Schiff. Phys. Rev. 78, 733-7(1950) June 15.

The cross section for the photoelectric disintegration of the deuteron by γ rays with energies in the range 20 to 140 Mev is calculated for various assumptions as to the interaction between neutron and proton. This interaction is taken to be central, half-exchange and half-direct, of approximately Yukawa and exponential forms, and with two effective ranges. Experimental data thus far obtained on neutron-proton processes do not provide a firm basis for distinguishing between these assumptions. Only the electric dipole and electric quadrupole cross sections are found, since the magnetic dipole cross section cannot be obtained reliably without explicit reference to a meson theory of nuclear forces. Use is made of a method for approximating to "long-tailed" potentials in such a way that the deuteron wave equation can be solved in simple analytic form. The results show relatively little difference between Yukawa and exponential potentials of the same effective range, either as to total cross section or angular distribution, but an appreciable difference from earlier calculations with a square-well potential, and a dependence on effective range. In the appendix, it is shown that at very high energies each photoelectric multipole cross section depends primarily on the coefficient of the lowest odd power of r in the expansion of the deuteron potential about the origin. (auth)

5076 A Lower Bound on the Range of the Triplet Neutron-Proton Interaction. Leslie L. Foldy. Phys. Rev. 78, 636(1950) June 1 (Letter to the editor).

The author obtains a lower bound on the range of the triple neutron-proton interaction by a method similar to that of Broyles and Kivel (Phys. Rev. 77, 839(1950)), but with the additional condition that the percentage of D-state has a fixed value. The maximum value of the quadrupole moment is found and equated to the experimental value for the deuteron quadrupole moment. This yields a lower limit to the range of interaction. If the percentage of D-state in the deuteron is less than 5%, the triplet range will exceed 1.75×10^{-13} cm.

5077 A Note on Electron Theory. C. Jayaratnam Eliezer. Proc. Cambridge Phil. Soc. 46, 199-201(1950) Apr. (Brief note).

The assumption is made that the charge of the electron is confined to the surface of a sphere. The equations of motion for this case have been deduced by Page (Phys. Rev. 9, 376 (1918)) and Schott (Phil. Mag. 3, 739(1927)). The author takes these equations as the basis for further investigations, his aim being to describe the motion of the electron by a system of equations such that, for a particle moving under no forces and with an initial motion in which the velocity and its derivatives are small, the solution of the equations of motion does not require the particle to attain a rapidly increasing velocity and so contradict the conditions under which the equations are assumed to hold. This treatment leads to a self-oscillatory motion for the free electron. Solutions for uniform and sinusoidal electric fields are also given.

5078 A Note on the Relativistic Invariance of Quantized Field Theories. J. S. de Wet. Proc. Cambridge Phil. Soc. 46, 316-18(1950) Apr.

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In an earlier paper (de Wet, Proc. Roy. Soc. A. 195, 365 (1948)) the author has demonstrated the relativistic invariance, for general transformations of coordinates, of the Einstein-Bose and Fermi-Dirac quantizations of linear field equations derived from higher order Lagrangians. The proof consisted of the identification of the commutation relations with the generalized Poisson brackets introduced by Weiss (Proc. Roy. Soc. A. 169, 102(1938)) and proving the invariance of the latter. In the present note, the same results are proved much more simply without the use of the Poisson bracket and without the restriction to linear field equations. The proof is of interest because of its extreme simplicity compared with other proofs. One instance of this is the fact that the same general argument proves the invariance of both types of quantization, whereas usually they have to be considered separately.

5079 The Radiation Theory of Feynman. F. J. Dyson. Helv. Phys. Acta 23, Supp. 3, 240-2(1950).

The author describes succinctly the basic ideas of Feynman's new approach to quantum electrodynamics. One departure from orthodox quantum theory is Feynman's use of the Lagrangian instead of the Hamiltonian as the basic function characterizing a system. The basic postulates of the Lagrangian method are discussed. Starting from these postulates and using various types of Lagrangian, a variety of relativistic quantum-mechanical systems can be described. A second departure of Feynman's from orthodox methods is his treatment of the positron. He uses the idea that a positron can be regarded as an electron traveling backwards in time. The whole theory of Dirac is reconstructed in terms of this idea. In resolving the paradoxes presented by particles traveling backwards in time, Feynman has made an analysis of the conditions that have to be satisfied by a quantum mechanical system in order that physical requirements of causality be preserved.

5080 Relativistic Heisenberg Picture. Bruno Zumino. Helv. Phys. Acta 23, 243-7(1950).

The single electron in a given electromagnetic field is treated by means of the Dirac equation. The Heisenberg

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formalism, corresponding to this equation, is not relativistically invariant form because the time is treated in a different manner from the space coordinates. The author avoids this difficulty, by introducing an independent spacelike surface, on which all dynamical variables, including the time, depend.

5081 A Sampling Method for Determining the Lowest Eigenvalue and the Principal Eigenfunction of Schroedinger's Equation. M. D. Donsker and M. Kac. J. Research Natl. Bur. Standards 44, 551-7 (1950) May.

This is a preliminary report on a sampling method for finding the lowest eigenvalue and the corresponding eigenfunction of Schroedinger's equation. The theory underlying the procedure is explained, and two cases are treated numerically. In a paper by Metropolis and Ulam (J. Am. Stat. Assoc. 44, 335(1949)) the Schroedinger equation had been brought in such a form that it could be interpreted as describing the behavior of a system of particles performing a random walk, while at the same time undergoing multiplication. The main point of this paper is to present an alternative method which involves a random walk but eliminates entirely the multiplicative process. This alteration in the model simplifies the numerical aspects of the problem. Although the initial results are encouraging, the authors feel that more experimentation will be needed to test fully the practicality of the method.

5082 The Theory of Electricity and Electromagnetism. R. Soudan. Arch. Sci. Phys. & Nat. 3, 5-16(1950).

The author assumes that the components of the metric tensor of general relativity depend, at least in first approximation, linearly on the ratio e/m, where e and m are, respectively, the charge and mass of a point charge producing an electromagnetic field. He then shows how Maxwell's equations may be deduced from the equations of general relativity. It turns out, however, that the electromagnetic potential does not behave as a four-vector in this theory. It is proposed that this four-vector may be illusory.